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[OFFICIAL NOTICE.]

Appointment of a Committee of Reception by the American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

The following named members of this Association are appointed and respectfully requested to serve as a Committee of Reception, whose duty shall be to call upon all foreign gas engineers visiting our country during the continuance of the World's Fair at Chicago, whose names and addresses may be obtained, and to introduce them to other members of our profession, see that they obtain permits to visit the neighboring gas works and other objects of interest, and generally to make their stay in New York as pleasant as possible, and when they leave for Chicago, to give them letters of introduction to the Committee of Arrangements at Chicago: Messrs. Wm. Henry White (chairman), Eugene Vanderpool, William H. Bradley, Fred. S. Benson, William R. Beal, Jos. R. Thomas, Thos. F. Rowland, Jr., Fred. W. Floyd and Oscar Weber.

The Guild of Gas Managers and the Society of Gas Lighting are respectfully requested to co-operate with this committee in extending hospitality to our visiting professional brethren.

A. E. BOARDMAN, President.
A. B. SLATER, JR., Secretary.

[OFFICIAL NOTICE.]

The American Gas Light Association's Greeting to European Gas Engineers.

AMERICAN GAS LIGHT ASSOCIATION, OFFICE OF SECRETARY, PROVIDENCE, R. I., June 5th, 1893.

To the European Gas Engineers—Greeting: The American Gas Light Association will hold its 21st annual convention in the city of Chicago, beginning on the date of Wednesday, October 18th, 1893. It would give the members of the Association great pleasure to meet there as many of the European gas engineers and managers as can make it convenient to be in attendance at the World's Fair at that time. It is suggested that all contemplating visiting the Fair arrange their visits so as to be in Chicago, if possible, at the time of this convention, when they will be most cordially welcomed by the Association and invited to attend the sittings of the body and participate in its discussions of papers presented.

Those engineers who cannot conveniently visit the World's Fair at that time, but must choose some other date, are respectfully requested to send their names and addresses, as soon as they arrive in America, to the AMERICAN GAS LIGHT JOURNAL, No. 32 Pine street, New York City, so that a committee from the Association may be made aware of their presence, and when they may be met, so that they may form the acquaintance of their professional brethren in this country and be made to feel less like a "stranger in a strange land."

A. E. BOARDMAN, President.
A. B. SLATER, JR., Secretary.

BRIEFLY TOLD.

THE PHILADELPHIA GAS RATE.—In our item columns for the current issue will be found a reprint of a communication, forwarded to Mayor Stuart, of Philadelphia, by Mr. James H. Windrim, Director of the Bureau of Gas of that city. When Mr. Windrim was appointed to the post of Director of Public Works of the Quaker City (and, of course, the Gas Bureau is one of the very important factors of the Works) it was broadly hinted in many quarters that he would not be up to the sensible overlooking of the gas supply of the city, the objectors basing their doubtings on the theory that no matter how capable a man might be as an architect—Mr. Windrim had won his spurs in the architectural field through a long and creditably sustained connection with the general government of the United States—it did not necessarily follow that he would figure well in the domination of a huge gas manufactory. Still, time tries all; and we have no doubt that the large majority of those

interested would, if appealed to for a straight out opinion, declare that Mr. Windrim has done more than well in his executive administration of the Public Works of Philadelphia in general, and of the gas division thereof in particular. On taking possession of the administrator's chair he found a trained working force in and about the Gas Bureau, and, wisely concluding that they were capable of maintaining the operation of gas manufacture and distribution, retained them at their posts, making merit and capacity the standards for their retention and promotion—in so far as a quasi-political manufacturing enterprise could be reasonably expected to do. The real difficulty that confronted Director Windrim, as it confronted his predecessor, General Wagner, was the criminal neglect, else idiotic apathy, of the appropriating power of the city, which, indifferent to the physical needs of the gas plant, stolidly refused to grant the funds necessary for the extension of the works—not only so, but the funds necessary for their proper keeping in repair—while driving the same far beyond their capacity, and exacting from the gas consumers a tribute sufficient, because of its exorbitancy, to partly cover up the woeful effects of a mismanagement that must be patent to the humblest laborer employed on the works. Persistently, however, Mr. Windrim kept at the task of punching the authorities to the point of awakening them to the true state of affairs, with the result that he now sees his way clear to asking them to institute such reforms that the gas consumer may have a portion of his all too heavy burden remitted. Any gas man would long for the opportunity to be permitted to sell gas in such a city as Philadelphia, without opposition, at the rate of $1.25 per 1,000 cubic feet; in fact, scores of gas capitalists, even in these hard times, would have no difficulty in raising several hundred times over the money needed to venture in such an operation. Yet the fact remains that public Philadelphia has to be humbly implored to make the "experiment." It is not our particular province to discuss the good policy of the city in its purchasing from a private corporation a quantity of gas equal to, say, 50 per cent. of the entire annual output, although we might remark that judging from the showing so far made, the city has not been a loser by so doing, which suggestion of a belief leads naturally to the inference that if half such supply is profitable to Philadelphia, the whole of the supply ought to be a trifle more profitable. In any event, Director Windrim's communication ought to lead to good results, and we are pleased to say, judging from the temper in which it was received by Councils, that not only will the consumer soon receive the slight morsel of benefit resulting from a 16⅔ per cent. reduction in gas rates, but he is also to be the gainer from the abolition of the practice now followed by the city of furnishing free gas to the public lamps and the public buildings. This blot of unequal taxation—for the gas consumer is the one who is thus called upon to pay the entire proportion of such tax that should be equally borne by the non-consumer—is unforgivably unjust, and has long been matter for wonder by those of other cities who occasionally consider the cause of their neighbors. The 16⅔ per cent. reduction, under the condition of obliging all departments to pay for the gas furnished them, will thus be considerable of a concession, in that the sum so received would in a comparatively short time (provided, of course, that it is expended in the rightful direction) put the Quaker City plants in a physical condition equal to the manufacture of gas at a cost that would put the retailing price thereof at a figure well under the proposed $1.25 scale of to day. The signs are hopeful of better promise for the Philadelphia gas consumer, and Director Windrim should be credited with his movement, no matter how it turns out.

THE OBVERSE TO THE PHILADELPHIA MEDAL.—Having discussed Director Windrim's appeal and argument, it is refreshing to turn to the report presented by the Providence (R. I.) Company to its shareholders, recounting the working of the Company during the 46th year of its existence. There we find that the Company is fully up to the task of supplying its patrons from works owned entirely by itself and managed by itself; and that although the output at Providence amounts roughly to but one seventh of the output at Philadelphia, the private Company sells to its customers at the rate of $1.20 per 1,000 cubic feet instead of the $1.50 rate prevailing in the Quaker City. And it should also be remembered that the Providence Company pays in the shape of taxes a sum which amounts probably to 12 cents on every 1,000 cubic feet of gas manufactured; and, to crown it all, the proprietors confidently proclaim, "We know of no better process of manufacture, and no better apparatus for the production of either coal or water gas in use than ours, and no plants in the land which are in better condition or showing better results than our own." Are we to accept these statements, made by the parties in control at each place, as influencing the moot-point whether private or public control is the better in respect of the ownership and operation of artificial lighting plants?

Processes for Manufacturing Gas from Oil, with Special Reference to the Peebles Process.

[A lecture by Mr. Ivison Macadam, F.I.C., F.C.S., before the North of Ireland Association of Gas Managers.]

That rich illuminating gas could be obtained by the destructive distillation of oils has been known for many years. In the earlier experiments, the ordinary greasy or fatty oils were employed; but the cost of material was so great that the works erected were rapidly closed. The oils used were principally colza or rape oil and train or whale oil. The amount of gas obtained was from 70 to 90 cubic feet per gallon of oil; while the illuminating power ranged from 30 to 70 candles. The cost was rarely below 25s. to 30s. per 1,000 cubic feet. These fatty or greasy oils are combinations of the triatomic alcohol, glycerine ($C_3H_5[HO]_3$), with fatty acids, principally palmatic ($C_{16}H_{31},HO$), stearic ($C_{18}H_{35}HO$), and oleic ($C_{18}H_{33},HO$). When destructively distilled, the glycerine passes, to a large extent, into the aldehyde acrolein (C_3H_3O,H); while the fatty acids yield a series of compounds of which the olefines form the greater part. The gas is, therefore, very rich in carbon, and burns with a smoky flame, requiring special burners for its consumption.

Next in time comes "coal oil." This substance is a very complex mixture of carbon and hydrogen compounds. It contains members of the benzol, paraffine, olefine, acetylene, and other series. It is obtained during the purification of ordinary coal tar, and is sometimes used as an illuminating oil. The specific gravity runs from .840 to .850 (water = 1.000). It contains proportions of the lower members of the benzol, olefine and paraffine series, which give it a low flashing point (65° to 70° F.) and a low burning point (70° to 80° F.) The yield of gas is however high—averaging over 100 cubic feet per gallon of oil, with an illuminating value equal to about 70 standard candles. The gas is rich in members of the olefine series, of which it contains upwards of 45 per cent. It also contains some members of the paraffine series, but only small quantities of the acetylenes. By the newer processes, this substance should give valuable results.

The most important classes of carbon and hydrogen compounds from which gas may be distilled are the petroleums and paraffines. The first of these terms is more strictly applied to certain naturally formed hydrocarbons found widely distributed over the surface of the globe. The term "paraffine" has been adopted for the materials derived from shales, etc., when these are destructively distilled in closed retorts with or without the admission of steam, and with or without the presence of air.

The natural hydrocarbons, while widely distributed, not only geographically but geologically, are found in large quantities only in a few localities. In Russia, the Baku deposits have been long known; in Burmah, the substance has been worked for centuries; in Japan and China, in Egypt, etc. With the exception of the Russian deposits, all other localities fall into insignificance beside the enormous underground reservoirs discovered in America. The vastness of these American deposits of natural oil may, perhaps, be better understood when I state that the area already proved, by boring and other means, is over 200,000 square miles, and that the production in the year 1882 reached a total of 30,460,000 barrels, or over 1,279,320,000 gallons, of which Pennsylvania alone sent out 1,174,757,220 gallons. Since then the output has decreased somewhat. In the case of Russia, the export is gradually increasing. In 1882 the total number of gallons manufactured was only 200,000,000; in 1884, the amount had risen to 429,400,000 gallons.

The American petroleums consist, chemically, principally of true paraffines ($C_nH_{n^2+2}$), with an admixture of the olefines ($C_nH_{n^2}$), and traces of the benzoles ($C_nH_{n^2-6}$). The Russian naphthas, on the other hand, are, to a large extent, made up of olefines, with some benzines, paraffines and acetylenes. They contain little or no solid paraffines. In America especially the lighter and more volatile members of the paraffine series (methane and ethane) are found in great quantities as natural gas, and are in admixture with hydrogen and small proportions of carbonic anhydride (CO_2). This natural gas is of high heating value, and is of the greatest importance in works requiring heat of great intensity, such as in the manufacture of steel.

Paraffine oils are obtained by the destructive distillation of shales in closed retorts. The total volatile matter in these shales varies greatly; but it may be stated at from 16 to 28 per cent., with a probable average of 23 per cent. When heated in the retorts, the yield of crude oil is about 12 to 13 per cent. The specific gravity is from about .860 to .880 (water = 1.000). The total production of crude oil in Scotland is equal to from 60,000,000 to 62,000,000 gallons per annum. There is also produced during the shale distillation from 4 to 6 per cent. of permanent gas. One sample of this gas gave, on analysis, the following results:

Carbon anhydride	15.40
Hydrogen	34.53
Carbonic oxide	10.72
Methane	4.02
Nitrogen	35.33
	100.00

The gas burns with a pale, almost non-luminous flame; and it is employed for heating the retorts, etc. It gives a hot flame, and is well suited for firing purposes. It is also used for lighting the crude retort benches; but for this purpose it requires to be carbureted by passage through light naphthas. When the science of oil distilling was less perfectly understood, this gas was purified by means similar to those employed for coal gas, and used for domestic lighting. Now the illuminating agents are almost perfectly separated, and the flame has become non-luminous.

Crude paraffine oil is made up practically chemically, to a large extent, of members of the olefine series, with less proportions of the paraffines and traces of benzoles and some acetylenes. It differs from the natural petroleum, which is more largely composed of true paraffines. The names, in fact, would be more descriptive if the term paraffine were confined to the American natural oil. The American petroleum is not so readily broken up into a permanent gas. In some experiments I made with a sample of burning oil of .799 sp. gr., I obtained 86 cubic feet of 66½-candle gas per gallon of oil. The decomposition, moreover, was not so complete as with other oils, and consequently when stored the gas lost a greater proportion of its luminosity by condensation.

Crude shale oil may be distilled into permanent gas with good results. But, as the material is either solid or semi-solid, it is very difficult to work; as even when heated it is liable to "set" in the small pipes leading to the retorts. In some tests made with an oil of .850 sp. gr., we obtained from a gallon 98½ cubic feet of permanent gas of 50 candle power. The crude oil contains impurities, from which it may be separated by distillation in a current of steam; and the resulting oil gives much better results when made into gas. During the oil distillation, the gravity is reduced to close upon .800; and a gallon of oil will then yield over 100 cubic feet of 70-candle gas.

Such oils, however, are not well suited for gas making with the older forms of apparatus; as, containing the light volatile hydrocarbons, they are highly inflammable, and are dangerous to store. At the same time they contain the valuable "burning" oils, the solid paraffines, and the heavy lubricating oils These bodies are generally extracted from the shale oil before the residue is employed for gas making. The process varies in different works, but generally consists first in distillation with steam, then in treatment with sulphuric acid, and afterwards with soda to remove certain nitrogenous alkaloidal bodies belonging to the pyridine series, etc., and tar acids of the carbolic series, etc. The oil is then again distilled, but the distillate is "cut" into two portions—(*a*) A light oil, containing naphtha, burning oil, and intermediate oils, with some of the softer solid paraffines; and (*b*) a heavy oil, from which is extracted intermediate and lubricating oils, and solid paraffines of the higher fusing points. These various fractions are extracted after repeated treatment with sulphuric acid and soda, followed by distillation—this latter aided by a current of steam. The products then are: (1) Light oils or naphthas (.750 sp. gr.), (2) burning oils (.805 to .830 sp. gr.), (3) intermediate oils (.840 to .870 sp. gr.), (4) lubricating oils (.870 to .890 sp. gr.) and (5) solid paraffine.

The light oils or naphthas may be distilled into permanent gas; but they are more usefully employed as solvents for india-rubber, as turpentine substitute for paints, for carbureting (mechanically) water gas, etc. The burning oils give a good yield of illuminating gas. An oil of .815 sp. gr. gave us 100 cubic feet per gallon of gas of 63-candle power; and a second oil of .830 sp. gr. yielded over 100 cubic feet of 50 candle power gas per gallon of oil. The solid paraffines are too valuable to be economically distilled, even were the mechanical difficulty of their solid condition overcome. The oil from which the solid paraffines of higher fusing points have been extracted is "green" oil, and may be readily converted into gas. A sample of .884 oil gave 102 cubic feet of gas, having an illuminating value of 53 candle power. This oil, however, still contains some of the softer solid paraffines, which can be removed by freezing, when the liquid becomes "blue" oil. This class of oil is also used for gas making with good results. The average result obtained by us may be stated at 128 cubic feet of gas of 54-candle power per gallon of oil. After further purification and distillation, this oil becomes "lubricating" oil of various gravities and "body." A lubricating oil of .873 sp. gr. readily gave 102 cubic feet of 61-candle power gas; while a heavy lubricating oil, of .894 sp. gr., gave 94 cubic feet of 57-candle gas per gallon of oil distilled.

It is, however, with the intermediate oils that the present, as well as the future, of oil gas making must remain. These oils, after the most careful fractionation and treatment, are too heavy to burn in ordinary lamps, as their viscosity is too high to admit of their ascending the wick by their own capillarity. They may, however, be burned to advantage in specially constructed lamps. They are also too light in body for use as lubricants, and are therefore almost waste substances. Before the days of oil gas, these oils were submitted to the process of "cracking;" and in America this is still carried out. The method simply depends upon the fact that the higher members of the olefine series, when subjected to a prolonged application of radiant heat at or near their distillation point, are converted partly into lower members of the same series, and partly into marsh gas (methane). The paraffines present are almost entirely converted into lower members of the olefine series. By this means the gravity is lowered, and the viscosity destroyed. After treatment with acids and soda, and a distillation, they may be used for burning in ordinary paraffine lamps. They, however, never give satisfaction, as, being so largely composed of olefines, they form combinations with the vitriol used in the treatment; and, on being burned, the wicks become loaded with sulphur compounds, and are charred. The products of combustion also contain much sulphurous anhydride (SO_2). Since the demand for "gas oil" has increased, cracking, in this country at least, has entirely disappeared, and the intermediate oils have now a distinct value in themselves. The flashing point of the intermediate oils runs from 230° to 250° F., and the firing point is over 280° F. There is, therefore, no danger from volatile inflammable vapors lodging in the store tanks. The yield of gas per gallon of oil is about 94 cubic feet; and the quality is close on 60 candles. The gas consists of about 35 to 37 per cent. of olefines—with methane, hydrogen, and some benzines and acetylenes.

Until the last few years an oil known as "gas oil" was on the market. This product was obtained by distilling the mixed tars formed by the addition of the acid and soda during the various stages of refining the paraffine oils. The gas oil was an amber-colored liquid, and contained leucolines and pyridines from the soda-tar and hydrocarbons especially rich in carbon. It burned with a very smoky, sooty flame, and gave a gas rich in acetylenes. The manufacturers now find that it is more economical to burn the tars as fuel below the boilers and stills. It is injected by a current of steam, and is a very valuable fuel.

The gas made from oil is employed either directly as an illuminant, or else to enrich other gas of a poorer quality. In the processes I propose to describe I have purposely left out those forms of apparatus which enrich poor illuminating gas by passing it directly through highly volatile hydrocarbons. Such processes are purely mechanical, and result simply in the suspension of the highly volatile liquid in a large body of a permanent gas. The patentees of oil gas apparatus have invariably attempted to distil the oil by one operation into gas; and their processes require considerable heat on the retorts. As bye-products, they obtain a condensable tar of benzol-naphthaline character and more or less carbon (*not coke*). The Peebles process, as I propose to show, makes no such claim, and the only bye-product is a hard and valuable coke.

Of the first class, I will describe the processes of (*a*) Pintsch, (*b*) Keith, (*c*) Alexander and Paterson (Kirkintillock), and (*d*) Brooks; and latterly I will take up the Peebles process, and show how it differs from the other methods.

Pintsch's apparatus is especially constructed to work burning and lubricating oils, or oils of the class intermediate between burning and lubricating. It is not at all adapted for crude or other oils which set to solid or semi-solid masses at ordinary temperatures. The retorts are Ω-shaped, and are worked in pairs. The higher retort has a tray placed in it, on which is received the oil to be distilled. The intention of the tray is to keep the cold oil from falling on the hot retort surface, and probably damaging it. Besides this, however, it acts as a vaporizer and as a collector of much of the carbon deposited from the oil, and thus aids in cleaning the retort. The oil, having become vaporized and partially broken up or decomposed in this upper retort, passes by a neck-piece, situated at the back of the higher retort, downwards to the lower retort, where, meeting with a higher temperature, the decomposition into permanent gas is fully accomplished. The gas then passes to the tar pit, where some dark liquid is deposited, and thence to condensers, where it is cooled, and to a washer and purifier, from which it goes to the gasholder. The condensers have nothing very novel about them, but the washer deserves description. It consists of a cylindrical column, in which is suspended an iron tray with a corrugated under surface, so constructed as to spread the gas and compel it to come in contact with the water. The gas passes by perforations in the side of the

tray to the upper gas chamber, and thence by a pipe to the purifier. This latter is of the usual pattern, except that the iron tray gives place to a basket-work square, on which is laid the mixture of oxide of iron and sawdust intended to remove any sulphur compounds that may be in the gas.

The quantity of gas produced by this apparatus may run at 90 cubic feet per gallon of oil; but, in ordinary working, from 80 to 85 cubic feet is looked upon as a fair return. From each 1,000 cubic feet of gas made, about 4 gallons of tar are obtained. This tar has not been very fully investigated, but in some experiments I made I was successful in isolating several members of the benzine series, some olefines and acetylenes, and a considerable proportion of naphthaline. It is said to find a market on the Continent, but, so far as my own experience goes, it is generally consumed as a fuel below the steam boiler employed to compress the gas. It yields a good heat, and is well suited for the purpose. At the same time it appears to be a great pity that so much valuable material should be lost. Generally the Pintsch gas is employed for the lighting of railway carriages, floating buoys, lighthouses, lightships, etc. In such cases the gas is compressed by powerful pumps into steel cylinders under pressure of about 13 atmospheres. The cylinders then supply the smaller portable cylinders, which, in the case of railway carriages, are generally fixed below the flooring.

On the Thames and Clyde, as well as on several other home rivers, Messrs. Pintsch have supplied floating buoys. These are generally spherical in form, with the lower part removed, and an inverted saucer-shaped bottom riveted on. This form of bottom is found the best to overcome the force of a current. The sphere is surmounted by an iron superstructure, holding the lamp and lense. In the newer form, the gas receiver is an independent receptacle placed inside the outer sphere. By this means the risk of damage by collision is, to a great extent, overcome. These gas buoys are usually charged at a pressure of from 5 to 10 atmospheres; have a consumption of 0.75 cubic foot per hour; give a flame with a candle power equal to about 5 standard candles, but which, by means of lenses, is increased to an apparent 17 to 20 candles; and burn night and day for fully 100 days without re-charging. The buoys are re-charged as nearly as possible each two months; but, having a much larger storage power, they can be safely left for a much longer period. At first, some difficulty was found in keeping the lights burning; but, by means of a very simple form of concussion box, this difficulty has been completely overcome, and I am informed by the Inspector of the Clyde Navigation Trust that such a thing as a light becoming extinguished is unknown. Besides these buoys, the Clyde Navigation Trust have several light towers, lighthouses, etc., working with the gas.

As showing the ease of working and saving of cost, I may instance the Garmoyle lightship, which previously required the regular attendance of a man and his wife, with an outlay for wages, oil, etc., of nearly £150 per annum. Now there is no attendant on board, and the gas is charged into two steel cylinders once each two months. The supply of gas is much in excess of the two months' requirements, and on one occasion the gas did not need replenishing till after fully three months, and then it was not exhausted. The cost for gas is about £12 to £16 per annum. The light burns continuously, and requires little or no attention.

All the Clyde installations are fed from one gas works situated at Port Glasgow, the gas being carried to the various points by a specially constructed screw steamer, the *Torch*. This beautiful little vessel carries two steel cylinders, which are kept fully charged, and the boat is always ready to go to any point should an accident occur. So far, only one instance has taken place in which her services have been necessary.

The Pintsch gas is also used for gas engines at Toward Point and Little Cumbrae. The apparatus at Toward Point is of 1-horse power, and works a fog bell; the Little Cumbrae gas engine is of 6-horse power, and is used to blow the siren. During the compression of the gas, a certain amount of loss is sustained by the condensation of part of the illuminants. This condensation is equal to about a gallon of hydrocarbon per 1,000 cubic feet of gas, and the loss of illuminating power is nearly 20 per cent. The initial candle power of the gas is equal to about 50 standard candles for each 5 cubic feet burned. The products under this system may shortly be stated to be, for 12½ gallons of oil, 1,000 cubic feet of gas, 4 gallons of tar, and 1 gallon of hydrocarbon. The hydrocarbon consists largely of benzines.

Many statistics as to the cost of the gas have been published by the various companies using this apparatus. Two of the largest railway companies put the cost, after deducting residuals, but exclusive of distribution or interest on plant, at 6s. per 1,000 feet, and their make at from 78 to 80 feet per gallon of oil.

Keith's apparatus differs in the form of retort from that previously described. It consists in a single through retort of Ω shape, but having in the center, midway between the back and front, a depression. The oil is fed in at the front, and the gas passes out at the back of the retort. This class of apparatus has been adopted by the Northern Lights Commissioners for installations at Ailsa Craig and Langness (Isle of Man). In both cases the gas is used for engines to blow sirens, and in the first case also for illumination. I have had no practical experience with this apparatus, but my father (Dr. Stevenson Macadam), under instructions from the Northern Lights Commissioners, went very fully into the merits of both Keith's and Pintsch's apparatus. The following is a summary of the results he obtained:

Keith's Apparatus.

	No. 1.	No. 2.
Gas per gallon of oil...	85.05 cubic feet..	84.82 cubic feet.
Illuminating value	63.25 candles....	59.52 candles.

Pintsch's Apparatus.

	No. 1.	No. 2.
Gas per gallon of oil...	90 70 cubic feet..	103.36 cubic feet.
Illuminating value	62.50 candles....	59.15 candles.

I am not aware of the quantity of tar produced in Keith's apparatus, nor how far the gas may be compressed, nor of the loss of illuminating value during compression. Before employing the gas for gas engines, Mr. Keith dilutes it with one half its volume of atmospheric air. The apparatus used is novel and efficient. The cost of the gas is stated to be 5s. 9d. per 1,000 cubic feet; but this sum does not include carriage of oil and coal, wear and tear of retorts, apparatus, etc., nor the cost of labor or distribution.

The Alexander and Patterson apparatus was intended at first for the production of gas from burning oil (.815 sp. gr.). Worked with this class of oil, it readily gave 100 cubic feet of 63 candle gas per gallon. Later, however, I recommended the use of intermediate oils, as gas can be produced from these at a much cheaper rate, owing to the smaller cost of material. In tests made with this apparatus and intermediate oils of .864 sp. gr., 94 cubic feet of a 56 candle gas were easily obtained. The apparatus is simple, consisting of a retort, the door of which is perforated to allow of the introduction of tubes. The oil is passed by these tubes to the back of the retort, being largely vaporized *en route;* it then comes in contact with the heated sides of the retort, and is permanently broken up into a gas, which is drawn from the front of the retort. After condensation in upright pipes, the gas is passed direct to the holder. Working with high-class intermediate oils well purified, the want of purifiers to remove sulphur compounds is not felt. The total amount of sulphur in the shale is not usually more than 1½ per cent., and of this only 0.028 per cent. can be traced to the crude oil. During the process of refining, most of this disappears. Where desired, however, the addition of a purifier is readily introduced. The apparatus is simple, easily worked, and especially suited for works or gentlemen's houses. It is working in several places and is giving satisfaction. Where a pure oil gas of high illuminating power is desired, and where this is not afterwards to be mixed with coal gas, the apparatus is one of the best I know.

The Brooks patent differs from all the foregoing, in so far as it is specially built for crude oils. The retort is most curiously shaped, in a zig-zag fashion, and the special advantage of this form is said to lie in the greater contact of the oil with the heated sides of the retort. The process also differs from the others in so far as there is introduced a current of steam, which is broken up along with the oil, thus increasing the quantity of the gas, although lowering its lighting quality. The process is largely in use in America; and it gives successful results. It is also patented in this country; but I am not aware of its being worked here. The peculiar form of retort is distinctly against its adoption; and I can see no reason for the form. Experience has clearly demonstrated that the process of gas making from oil consists, chemically, in the degradation of higher carbon and hydrogen compounds to lower forms, accompanied by the production of bodies rich in carbon and free hydrogen, etc. These processes are best carried out by heat radiated from a large surface, and not by direct contact with the metal. Direct contact leads to the production of much free hydrogen, and the deposition of free carbon in the retorts, with consequent loss of illuminating power. This has been fully brought out in experiments made by my father so long ago as 1872, with an apparatus packed with coke, and by myself in tests made with thin tubes. Further, the temperature required to break up oils into permanent gas of high illuminating value is an orange red, while a white heat increases greatly the gas produced, but practically destroys the illuminating power. With small tubes, or zig-zag apparatus, it is almost impossible to regulate the temperature.

The Peebles process differs essentially from any of the other processes mentioned, for while these act by one direct heat action, the Peebles process, by means of a lower heat and constant return circulation of the condensable products, only gives a partial breaking up at each circulation. In the newer forms of apparatus, as at Galashiels, the coal gas and oil gas retorts are back to back; and the waste heat of the former serves to heat the latter. The retorts need not, however, be so placed, for at Peebles the coal gas and oil gas are made in the same oven; but for economical working the Galashiels setting should be the best. The coal gas retorts are of the usual ⏢ shape and size, and are set in the ordinary way, while the best form of retort for the oil gas is cylindrical. The Galashiels retorts are 9 feet long and 27 inches internal bore, and they are laid with a backward inclination. From the front of the retort there is an ordinary ascension, bridge and dip pipe to the hydraulic main. The condensers are nearly horizontal, with a slight upward tendency, and lead to a scrubber, on the principle adopted regularly in shale oil works. The trays in the scrubber are fed with oil from a cistern attached to the upper part of the apparatus. From the scrubber the gas passes to the ordinary dry purifiers, where it meets with the coal gas, and the mixed gases then go to the holder in the usual manner. The oil for the retort is obtained from what is called the compensating tank. In this tank the overflow from the hydraulic main, the liquids from the condensers and the fresh oil are intermingled, with the result that a perfectly liquid substance is maintained throughout the whole of the working. Moreover, the apparatus, being of considerable size, acts as a settling tank, in which any solid carbonaceous matter is removed. The oil passes from the compensating tank by means of a pipe, with a regulating valve, to the ascension pipe, where the introduction of the liquid oil tends to wash the ascending gas and remove any suspended carbonaceous particles. By this circulation method liquid residuals are avoided, and the residue left in the retort, when it is coked down, is a dense and very pure carbon, with less than 0.5 per cent. of ash, and readily burned. For this solid residue 20s. per ton has been regularly obtained at Peebles. It yields a smokeless flame of great heat intensity. The gas yield by this method runs, with "blue" oils, from about 85 to 86 cubic feet per gallon, and the illuminating value when the gas is burned by itself is about 59 candles. When burned in admixture with poorer illuminating gas the value is much greater. A month's actual working yielded:

Coal gas	1,217,600	cubic feet of	18.00 candle power.
Oil gas	253,500	" "	
Total gases	1,471,000	" "	30.51 "

Coal gas.....1,217,600 ÷ 5 = 243,530 × 18.00 = 4,383,360 candles.
Total gas .....1,471,000 ÷ 5 = 294,200 × 30.51 = 8,976,042 "

Therefore the candle power from 253,400 cubic feet of oil gas = 4,592,682 candles, which, divided by the make (253,400 cubic feet) = 18.12 candles per cubic foot, and multiplied by 5 = 90.60 candle power as the true illuminating value of the oil gas as an enricher. This gain in illuminating value by mixing is equal to 53.74 per cent. To explain this gain we need to consider several points. When any complex body is subjected to a sufficient amount of heat, it is resolved into its elementary constituents, or into more simple bodies. If the heat applied be great enough, the ultimate particles will be driven so far apart that chemical union is rendered impossible. If, on the other hand, the heat is less, only partial decomposition results; and the substances produced are still compounds, although less complex than the original substances acted upon. If the oil be subjected to the highly heated surface of a retort, the decomposition is almost complete—methane is formed, any oxygen goes into carbon monoxide or dioxide, hydrogen is set free, and all excess carbon is deposited as free carbon. If, on the other hand, the heat from the furnace is compelled to pass through the sides of the retort, and to be communicated to the atmosphere of the retort, which, in its turn, radiates the heat on the volatilized oil, the resulting decomposition will not be so complete, and the gases left will be more complete in nature, and more highly carbonaceous. To produce light from carbonaceous gases, the carbon requires to be set free, and then raised to a considerable temperature, so as to become incandescent. The incandescence may lead only to a glow, or, as the temperature rises, to a more decided light. If in the gas flame the heat (in this case derived from the burning of the hydrogen, carbonic monoxide, etc.) is sufficient to produce a temperature great enough, the maximum of light will result. If these gases are too small in amount, then the flame becomes smoky, and the light less. In oil gas the last condition holds good, and the balance is brought about by the admixture with a poorly carbonaceous gas containing much hydrogen, and which on burning gives sufficient heat to render the excess carbon of the oil gas incandescent. In other words, the excess of carbon in the oil gas is rendered incandescent by the excess of the heat producing bodies in the poorer gas; and the result is an excess of light over that obtained from either gas alone. The 18-candle splint gas becomes valuable as an enricher on account of the excessive heat of its combustion, and the 59 candle power oil gas enriches on account of its excessive carbon. Both gases are required to give the desired result, and both therefore have a claim on the excess of light obtained from admixture.

I have seen the Peebles process on several occasions, and can testify to the ease of working and regularity of the product; and I feel sure that the process has a great future.

German Economy in Bye-Products of Coke.

The *Am. Manufacturer* notes that in a recent report to the State Department at Washington, Consul-General Mason of Frankfort gives an account of the development of iron and steel manufacture in Germany. He notes the marked progress made by Germany in this line which he says is largely due to the fact that the Germans have succeeded in saving the bye products of coke manufacture. On this subject he states that the improved methods now in use, and which have produced the best results, are mainly the work of the past five years. What is known as the Semet Solvay system is the one principally in use in Belgium; but the most advanced representative of German progress in this direction is probably the Otto Hoffman coke oven, of which there are about 1,550 now in use—535 in Westphalia, 700 in Silesia, 75 in the Saar district, and 240 in Austria. Although elaborate and costly in construction, this oven is durable and, by reason of its great saving in gas, highly economical in operation, aside from its efficiency in saving the subsidiary products. The complete apparatus is a combination of the Otto oven (32 feet long, 16 inches wide, and 5½ feet high) with the Siemens regenerator in such a manner that the air to be used for the combustion of gases is first heated to a temperature of about 1,800° F.

For the most economical service these ovens are built in groups or batteries of 60, and half the number are alternately filled each 48 hours. The oven has three openings through which it is charged from above with 6½ tons of air-dried coal. The openings being then tightly closed, heat is applied, and the gases generated are drawn off through collecting pipes by the action of a suction fan into coolers and scrubbers, where the tar and ammonia are deposited in water by mechanical distillation. The gas, thus purified of tar and ammonia, is then reconducted to the bottom of the ovens, where it is mingled with the heated air above mentioned and burned as fuel in the process of roasting the coal. The percentage of gas produced varies somewhat with the quality of coal used; but with all the German coals the gas thus generated is greatly in excess of what is required for heating the ovens, and the surplus is available for making steam, lighting and for other purposes. For a long time there prevailed among German ironmasters a notion that coke produced by any process that saved the bye products was thereby injured for iron making, but this is now completely dispelled. The coke made by the above process is conceded to be of the highest quality for all purposes.

A battery of 60 ovens, working under the above conditions, would furnish gas for their own heating and yield a surplus of from 76,000 to 96,000 cubic feet per day to be used for other purposes. It is reckoned in practice that 100 cubic meters (3,200 cubic feet) of this surplus coke gas is equivalent, for purposes of heating, to 87.5 kilograms (193.5 pounds) of coal; and the saving of fuel in working 60 coke ovens would therefore be:

District.	Per Day. Kilograms.	Per Year. Tons.
Ruhr	21,000	7,560
Silesia	26,250	9,450
Saar	21,000	7,560

But, since the Otto-Hoffman oven involves, also, the use of other appliances which require heat to the extent of one-third the amount saved in the form of gas, it follows that the actual economy in fuel is about two thirds of the above totals expressed in coal. Add to this saving of coal the two bye-products—sulphate of ammonia, worth in the market $5.23 per 100 kilograms (220 pounds) and tar, worth about 95 cents per 100 kilograms—and the enormous profits which are claimed for this system do not appear incredible.

From another but trustworthy source it is announced that the revenue actually derived from the tar and ammonia produced by one year's working of a group of 60 ovens in Westphalia, which cost in construction $166,000 (or $2,766 each), was $40,200, or about 25 per cent. on the capital invested in the plant. The price given above does not include the cost of condensing apparatus, which, although it is not a part of the oven, is worked in connection with it.

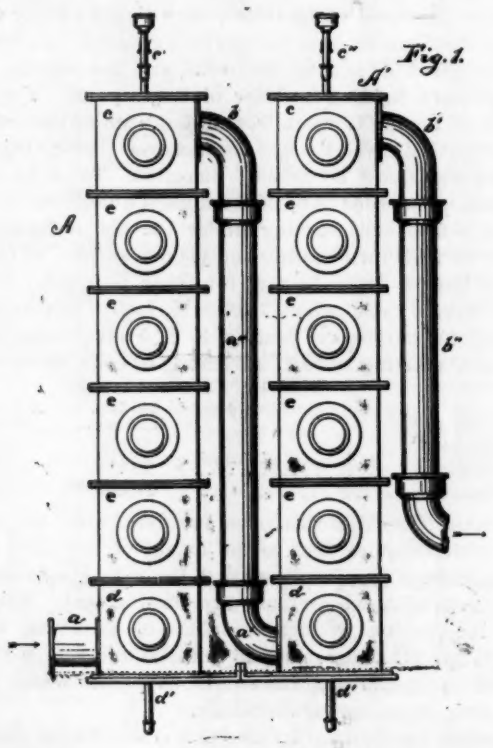
The direct production of benzole in the coking process is difficult, but it has been successfully accomplished during the past year by an inventor at Dortmund, whose process is thus far a secret. So far as can be ascertained, from 6½ to 15 pounds of benzole are obtained from a ton of dry coal; and, as benzole is an important element in aniline manufacture, it may be ranked among the products that will always have a standard value.

Still another point in which the Germans secure an important advantage, especially as respects their American competitors, is in economizing the waste and coarser forms of fuel. It is conceded that Americans are masters of economy in labor, but they are extravagant with materials. In our country millions of tons of coal dust—the waste of mines, railways and iron mills—are thrown away as useless. An official commission, after exhaustive study of the subject, has recently published the astounding information that for every ton of anthracite coal mined and marketed in Pennsylvania, 1½ tons are wasted; and the loss in bituminous coal, although somewhat less, is still enormous. In Germany, France and Belgium all this refuse coal dust is carefully saved. Part of it is mixed with pitch derived from tar distillation and molded into "briquettes." which are used as fuel for locomotives, stationary engines, and household grates. The remainder of this finely pulverized carbon is blown by jets of live steam into various kinds of furnaces, where it burns with almost the fierceness of crude petroleum. Coal dust from mines costs in Germany 25 cents per ton on cars, or in large quantities $2.38 per carload of 10 tons, and the care with which it is saved and utilized adds an important percentage to the fuel supply of this country. It is by this application of scientific economy to every stage of manufacture, the saving of secondary products, and the invention of new processes and machinery to work most advantageously native materials that the German iron and steel makers have been able to face without disaster the declining metal markets of the past four years.

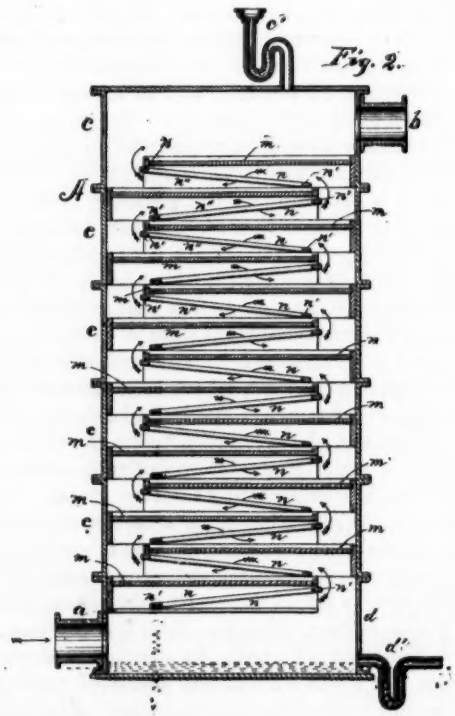
The Wood-Tuffs Washer and Scrubber.

On August 15 U. S. Letters Patent (No. 503,395) were granted to Messrs. Austin C. Wood and John H. Tuffs, of Syracuse, N. Y., for "useful improvements in washing and scrubbing" apparatus. Using the words of the specification:

Our object is to produce an ammoniacal liquor and water scrubber in which the gas is brought into maximum contact with ammoniacal liquor and water, said liquor and water being both substantially stationary and also in motion or flowing or running, or running and dripping, the flow of



the gas being zigzag and practically, if not absolutely, unobstructed, and in a direction opposite to that of the liquor and water; and comprising horizontal pans or tanks, and diagonally disposed frames of headers and slats secured together with spaces betweens the slats, said pans and frames being arranged in sets or pairs, one above another, in a series of benches, comprising a tower, and when desired several towers can be used, each being provided with an ammoniacal liquor or water inlet pipe at the top, and an outlet pipe at the bottom, and having a gas inlet pipe at the bottom or top and a gas discharge pipe at the top or bottom, the outlet pipe from one tower being prolonged downward and connected to or forming the inlet pipe to the next; all so that when the liquor and water is let in at the top of the respective towers, it will fill the top pan, overflow therefrom onto the upper end of the frame under this pan, flow



down, over, around and between and along the slats, all of said liquor and water being thereby conducted to and discharged into the second pan, and thence onto the second frame, and so on, so that so long as the flow of liquor and water continues, the pans are full and the slats of the frame are covered with running liquor and water, and the gas, as it passes over the tops of the frames through between the slats and along under the slats and over the tops of the pans, is exposed to the liquor and water to the maximum degree, and is purified and the ammonia is extracted therefrom by the liquor and water in an exceedingly thorough and efficient manner, the ammoniacal liquor finally passing out at the bottom of the respective towers.

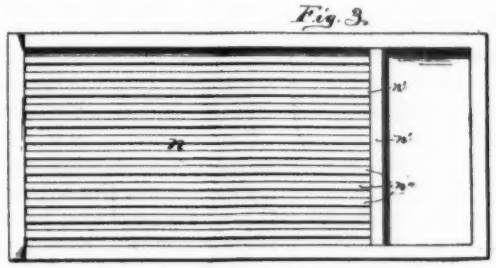
Our invention consists in the several novel features of construction and operation hereinafter described and which are specifically set forth in the claims hereunto annexed. It is constructed as follows, reference being had to the accompanying drawings, in which Figure 1 is a front elevation of a scrubber consisting of two towers. Fig. 2 is a vertical longitudinal section of a tower. Fig. 3 is a top plan of one of the slat frames, showing part of the liquor or water pan below it. Fig. 4 is a vertical longitudinal sectional elevation of one of the water pans and of a slat frame below it.

A A' are the towers, the first being provided with a gas inlet pipe *a* at the bottom, a gas outlet pipe *b* at the top; the second with the gas inlet pipe *a'* at the bottom or top, and the gas pipe *b'* at the top or bottom; *a''* being the conduit pipe connecting the outlet pipe *b* to the inlet pipe *a'*, and *b''* being the conduit pipe for conducting the gas from the outlet pipe *b'* to another stack, or to the gasholder or storage tank. As these towers are counterparts, we will here only describe the construction on one tower. Each tower consists of a top and bottom bench, of box-like form *c* and *d*, respectively, open on one side, top or bottom, as the case may be; the top bench being provided with the ammoniacal liquor inlet pipe *c'*, and water inlet pipe *c''*, suitably trapped to prevent the escape of gas, and the gas outlet pipe *b* (or *b'*) is connected thereto; and the bottom bench is provided with the trapped liquor outlet pipes *d'*, and the gas inlet pipe *a* (or *a'*) is connected thereto. The intermediate benches *e* consist of boxes, open top and bottom, and all of the benches are flanged exteriorly as part of the means for securing them together in building up the towers. Iron tubes can be substituted for the flanged boxes; the size of boxes or tubes, the number and the height of the towers, to be made to correspond in capacity to the make of gas.

In each bench one or more flat horizontal tanks or pans *m* are mounted, each somewhat shorter in one direction than the interior of the box

on the same line, so that when mounted in alternation, a zigzag passage-way is created through which the gas passes freely, its area in cross-section being at least equal to that of the gas induction pipe, and the eduction pipe also. Under each of these liquor and water pans a frame n is mounted in an inclined position, consisting of transverse headers n' and longitudinal slats n'', all usually of wood, though they can be of iron. These frames are shorter than the pans, are mounted so that each pan overflows at its end onto the upper end of the frame below it, and

Fig. 3.



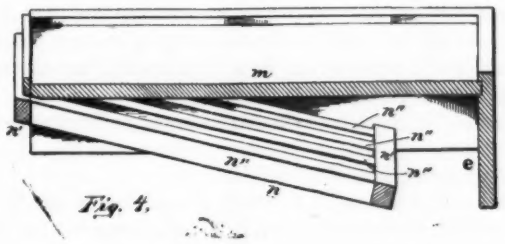


Fig. 4.

the water runs, flows or trickles down over the top, sides and bottom of each slat; each slat being thus always covered with a film or thin sheet of water, and as substantially all of the gas passes through between the slats, and also is in contact with their upper and lower surfaces; thus not only giving the gas the maximum contact with water, stationary or in motion, and at the same time presenting the minimum of obstruction, especially when the area of the spaces between the slats in the frame is at least equal to that of the inlet and outlet pipes. When the gas has passed upward through the first tower, the outlet and conduit pipes conduct it into the bottom of the second stack, and from that it is conducted to another stack in like manner, or by suitable piping in the holder or storage tank (not shown).

What we claim as our invention, and desire to secure by letters patent, is—

1. A gas washer and scrubber comprising an outer casing, a series of water pans mounted therein, and a series of slat frames mounted in the casing and alternately arranged with said pans creating a zigzag passage, in combination as set forth.

2. A gas washer and scrubber comprising an inclosing case, water pans, and inclined frames composed of headers and longitudinal slats secured together, both mounted and arranged in alternation with each other, and separate inlet and outlet pipes for gas and water, in combination.

The Loomis Patent Furnace Grate.

On Aug. 15th U. S. Letters Patent (No. 503,211) were granted to Mr. Burdett Loomis for certain improvements in the construction of furnace grates. In his specification the inventor says:

This invention relates to an improved arched firebrick grate adapted for gas producers used in generating fuel gas to heat steam boilers and for other purposes.

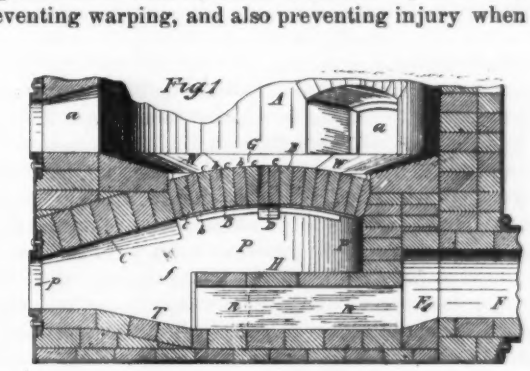
The object of this invention is to provide a hearth which is simple in construction and is much more durable in use than the usual iron grate, and also to provide a hearth which shall be capable of standing a high heat without danger of being melted down by the highly heated fuel gas which passes down through it and thence through a flue leading from the base of the furnace to the base of the steam boiler.

The matter constituting my invention will be described in the claims.

I will now particularly describe my improved construction of grate by reference to the accompanying drawings, in which Fig. 1 represents a vertical section through the base of the furnace, showing my arched brick grate in position, the section through the grate being on the line $x\,x$ of Fig. 3. Fig. 2 represents a vertical cross-section on the line $y\,y$ (Fig. 3) through the main cross bar of the grate. Fig. 3 represents a top plan view of the grate detached from the furnace.

At the base of the furnace A, a part of which is here represented, I construct an annular inclined hearth W, extending inward from the outer wall of the furnace, as shown in Fig. 1, and within the central opening of said hearth I construct the arches forming the grate G. Below the hearth at the front of the furnace I construct an arch C, forming the top of the ashpit P and its opening p to the outer door. The rear wall p' of the ashpit P is made semi circular, as shown, and is supported upon the vertical tile n, set at suitable distances apart upon the floor T. The vertical tile n also serves to support the floor H of the ashpit. The rear wall p' closes the ashpit from direct communication at the back with the escape flue F, so that the heated gases must pass from the front of the ashpit through a passage f, and thence below the floor H, between the vertical tile n, on their way to the escape flue F. The lower part of the fuel chamber is provided with openings a, above the hearth, for giving access to clean the grate and regulate the fire, which openings, in practice, are provided externally with tight-fitting doors.

The arched grate is composed preferably of firebrick, and is constructed with the main cross bar D extending diametrically through the middle of the furnace, or through the opening in the inclined hearth W, as shown in Figs. 2 and 3, and of the parallel bars B, which extend in regular order across the opening in the hearth and intersect or join with the main cross bar D, as shown in Fig. 3. The main cross bar D is preferably arranged at right angles to a plane passing from the front to the rear of the furnace, and the bars B are arranged so as to extend in parallel lines from the front to the rear of the furnace, so that the fire can be more readily cleaned with a bent bar or poker. The main cross bar is composed of the wide wedge-shaped brick d, which project at their corners in between the brick of the cross bars B and of brick e, which are made narrower at their upper end than the brick $b\,c$ composing the arched bars B, so that the bricks are bonded at the junction of the arched grate bars B with the main cross bar D, as shown in Fig. 3, thus preventing warping, and also preventing injury when the fire is



cleaned. The arched grate bars B are composed of alternate common rectangular firebrick b, and of the "bull head" or wedge shaped brick c, as shown in Fig. 1.

The grate composed of the bars B, bonded with the brick of the main cross bar D, is very strong and durable, capable of standing a high heat and a great pressure. This grate is securely supported by the arch C, at the front of the furnace, and the heavy brickwork at the rear.

My improved arched brick grate is intended for use in a down draft gas producer in which the air for supporting combustion is drawn down through the body of fuel, fresh fuel being supplied at the top, and the resulting gaseous products being drawn off down through the grate and

passed through the ashpit and thence through flue *F* to a steam boiler or other furnace, where they are burned. Air for burning the fuel gas may be admitted by the opening *p* at the base of the furnace, or may be admitted into the steam boiler furnace close to the gas inlet ports.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination with the furnace, the parallel brick arches and the main transverse arch composed of brick constructed to interlock and form a bond with the brick of the parallel arches, substantially as described.

2. In a furnace the grate composed of parallel brick arches *B* and a main transverse intersecting brick arch *D*, containing brick *e* at the intersections with the parallel arches of less diameter than the brick of such arches, and the brick *d* of arch *D*, interlocking with the brick *b* of arches *B* to form a bond, substantially as described.

3. In a furnace the grate composed of parallel brick arches *B*, formed of bricks *b c*, and the main transverse intersecting brick arch *D* formed of brick *d* and of brick *e*, placed at the intersections of the arches, and which are narrower at their upper ends than the bricks *b c* of the arches *B*, whereby the bricks of the parallel arches and the intersecting arch are caused to interlock and form a bond, substantially as described.

Advantages of Shafts over Slopes in the Economical Working of Coal Mines.

The following is a summary of a paper read before the last meeting of the Western Pennsylvania Mining Institute by Mr. Fred. C. Keighley, on the "Advantages of Shafts over Slopes," which has been given in reply to one read at a previous meeting by Mr. Wm. Duncan, Mine Inspector, on the subject of "Advantages of Slopes over Shafts."

The operating of a coal mine rarely gives the results calculated upon or that one figured out by a lead pencil on paper; however, if one cannot obtain the results shown by pencil and paper, we can in a measure forecast the probabilities of a mine.

Mr. Duncan in his paper says that as all knowledge is gained by comparison, it is necessary to adopt some unit of measure, and for this purpose he chooses the dollar—a choice which I willingly accept.

Mr. Duncan in considering the question selects an ideal coal field which may be operated either by shaft or slope. In making this selection he is not fair, because it allows him to make the coal field fit his plans, instead of the plans to fit his coal field. He assumes likewise that the average grade or dip is 5 feet to the 100 feet. In operating a colliery having a capacity of 1,000 tons of coal per day, to be made into coke, large coal bins would be required, for which we should want a total height of 45 feet, which at the grade mentioned would give a length of 900 feet. Of course, by making the grade of the structure 10 feet in 100 we should reduce the length to 450, which would require a stronger engine than would be necessary for the slope of 5 in 100.

By having a shaft it would not be necessary to put the coal 900 feet away, but it could be dealt with within 25 feet of it.

I will venture to say there is not now, never was, and never will be a slope driven 5,000 feet at the grade assumed by Mr. Duncan on the coal in the Connellsville coke region; indeed, I question whether a slope can be driven there for such a distance uniformly within the natural stratification at any degree of dip.

It will cost less to put an engine to hoist at a shaft than it would at a slope of Mr. Duncan's ideal.

Mr. Duncan says that shaft sinking will cost $100 per foot; but I may mention an example of a hoisting shaft in the Connellsville coke region having been sunk 310 feet deep at a cost of $50 per foot, timbered and all complete.

In the care of the shaft 5,740,000 tons would have to be lifted 227½ feet, and 45 feet to the tipple, making a total lift of 272½ feet, or a grand total of 1,564,150,000 foot tons, which is 42,650,000 foot tons less work to be done by the shaft engine than the slope engine.

In the case of the slope, with a coal field 5,000 feet square, with the slope carried down from the crop, the tipple would have to be placed 875 feet further away than would be necessary in the case of a shaft, and to suit Mr. Duncan's arrangement he would have to buy another farm to build his erections upon for tipple, bin, etc.

I question Mr. Duncan's statement that 3 tons of water have to be lifted for each ton of coal—although this may have occurred in some cases, or even 30 tons of water to a ton of coal; but this need not have been done if shafts had been sunk instead of slopes.

The quantity of water pumped at Oliver Shafts last spring amounted to 60,000 gallons a day, which is equal to 87,600 tons per annum; whereas the output of coal amounts to about 300,000 tons per annum.

At Leith Shaft, Uniontown, Pa., the average quantity of water pumped is 3½ tons to 1 ton of coal hoisted. This large quantity of water is the result of taking coal from under the streams.

At Leisenring, 4 tons of coal to one of water are lifted. At Trotter Shaft, very old, the water pumped is 1.3 tons to one of coal. At Leisenring No. 1 the coal hoisted is 5.3 tons to one of water. At the Monastery Mines, near, Latrobe—a slope mine—in wet weather 3,417 tons of water are lifted in a day, and 2,239 tons in dry weather. At Oliphant Slope, Oliphant, Pa., 3.07 tons of water are pumped to one ton of coal.

All the great trouble from water in the mines of the Connellsville coke region is and has been at slope mines. I dispute the claim that material can be handled with greater facility at slopes, for according to my experience, with the exception of **T** rails, material can be handled with greater facility at shafts than slopes, without interfering with operations.

Mr. Duncan's suggestion to carry the slope to the extreme boundary and then work the coal backwards is a very good one, but the time and capital required for doing this prevent many from contemplating it.

One great objection to slopes is that the ventilation is interfered with by the movement of the cars. A slope is generally used as the main intake or main return, and in either case when the cars are running against the current they either reduce it, stop it, or turn it the other way—as I myself have seen by holding an anemometer on some of the slopes in the coke regions.

In conclusion I claim for shafts the following advantages over slopes, namely:

1. Shafts are safer than slopes.

2. As a rule there is much less water to handle in shaft mines, and there is no sudden or great increase in the quantity of the water during wet weather; if there is any increase it is generally gradual.

3. The general drainage of the mine is much better, because the working is generally up grade instead of down.

4. Water can be dealt with more expeditiously and at less expense than in slope mines.

5. Fewer steam and water pipes are needed. I know a case in a slope mine where the pressure of steam at the pump was only 40 pounds, whilst at the boiler it was 115 pounds; the length of pipes being 4,300 feet.

6. It is perfectly feasible to dispense with nearly all the pumping arrangements and pumps at a shaft, for the water can be hoisted in tanks after the coal is hoisted.

7. Large, regular and sustained outputs can be reached more quickly by shaft than by slope.

8. There is more perfect control over the ventilation, and in case of accident by explosion it can generally be restored more easily than in the case of slopes.

9. The miners have not to slide down chutes in going to work in the morning, nor to climb a mountain every night after a hard day's work.

10. The regularity of the output from beginning to end.

11. The profit per ton of coal extracted is much greater. The cost of mining coal in certain slope mines I could mention ranges from 25 to 35 cents per ton of coke more than at the shaft mines of the same company.

Testing White Lead.

It would look, at first sight, says a writer in *Painting and Decorating*, as if a paper written upon this subject at the present time, when the very air seems to be loaded with it, would be about as opportune as the carrying of coals to Newcastle, and would be simply adding one more to the mountain of able papers that have already been written, and which have appeared of late in the various trade magazines.

To many, what the writer has to say may appear as a rehearsal of ancient history; yet some of the ideas presented may be new to many readers; therefore, no other apology is offered for inflicting another paper upon the kind indulgence of our readers.

The chemical composition of white lead is of little interest to most practical painters, and this paper will treat only upon the working and testing of lead, as its heading indicates, and upon which is the most economical white lead to use.

Chemistry has its uses for determining the purity of lead, etc. This is so well understood now by most men who have given it any attention that nothing new could be said, at least by the writer. What does the practical man care if this lead can be made by this or that process; or whether it took three days, three months, or three years to corrode it? Whether it was precipitated or corroded by this or that system of Dutch process? What is all that to a practical man? Let some chemist (if it were possible) make a white lead by muttering some magic words of

necromancy—instanter—in the twinkling of an eye, and what does he care, if the lead produced thus answered his purpose!

The purposes for which he wants white lead are manifold. First: He wants it to be dense, so it will cover well; in other words, he wants it to have a good body, in painters' parlance. Second: The next point of importance, and one which with many painters might be said to be of even greater importance than the first, is its good working qualities. Third: Its fineness and texture, upon which, to a certain extent, is due the greater or lesser quantity of oil that can be incorporated with it, and beauty of finish, and from which fineness is in a great measure derived. The next point which comes last but not least. Fourth: Durability; this culminating point the practical painter must have in a white lead, in as great a degree as the nature of the pigment itself will possibly allow.

If, then, as said before, these four requisites which are recapitulated below:

1. Body and density,
2. Good working properties,
3. Fineness of texture,
4. Durability,

can be found in a lead, that lead will be welcomed, no matter how it came into the world, whether it is stack, cylinder, or whatever other system of Dutch process form it may be, or even by instant precipitation, if ever some such method can be found which will make a dense lead; that is the lead wanted and wanted badly, too, by the practical man.

That lead may be pure and condemnably poor (not to use a stronger but uglier word), is a fact only too well known to most painters; so, the ordinary guarantee pasted upon the kegs, that so much money will be paid, in the contingency of the contents of the package being found adulterated, is of itself a very poor consolation to the painter who finds that his lead is badly colored, covers poorly and is always ready to drop out of his brush in tears (for shame, no doubt, for having to be passed off as a first-class article of strictly pure white lead, to which it knows itself not to be entitled.)

Therefore, it is repeated, with emphasis this time, that lead may be very pure but very poor for all that.

The manufacturers of white lead who are so solicitous for trade, and who harp so much upon the purity of their products, should try their hands also upon the requisites so imperatively demanded by the men who use the goods.

The main trouble, no doubt, attaches to the careless management of the operations after, as well as during corrosion, and such may be said positively to be the case.

Whether painters have become more discriminating than they formerly were or not is not known, but they claim rightly, so far as the personal observance of the writer goes, that of late years a good deal of the lead upon the market shows gross negligence and carelessness in its preparation (although labelled strictly pure). The lead is pure—that's enough, and that ends it.

Good lead should and must be pure; that is a very essential requisite, but as it belongs rather to the chemist to prove that, the practical painter is not supposed to know how to determine that in an absolute manner. Yet, even he who knows not the name of a single element of chemistry, can most easily determine purity for himself by the use of the blowpipe. No doubt, one of these days, some chemist will kindly publish some easy method of determining the presence of sugar of lead, if any be present in white lead. When some one does that, he will deserve an equestrian statue 40 feet high in the most conspicuous plaza of Christendom. The method must be simple and as easy of application as the blowpipe test is, or it would be useless to the ordinary practical man.

As to the balance, the practical painter has the remedy in his own hands to some extent, by working out practical, sensible tests which everyone can make for himself.

"But," some will say, "how can we be guided by tests? Here is a package of lead with a certain manufacturing firm's label upon it; it works well and has good body, but only two weeks ago the same make of lead, but from another lot, had poor body and execrable working properties! What is the good of testing that? Suppose I test with a good sample of that brand and the next batch happens to be poorly made, what am I to do?" Unfortunately, yes, this is a bad phase, and will hinder the making of accurate tests to guide your future purchases, but the very fact of certain brands running unevenly ought to be sufficient reason for you to let such brands severely alone.

There are manufacturers who have attained a well-earned reputation for the uniformity of their output, and by taking some such lead for a standard of comparison, and an average lot of some other brand which you desire to test, to ascertain its comparative value in dollars and cents, in body for spreading capacity, in testing the relative merits of their working properties, in the softness of finish, whiteness, and the closeness with which it lays to the wood, freedom from ridges caused by the bristles of the brush in laying on the paint, and, if you will only give it sufficient time, in their comparative durability. When you have ascertained this to your entire satisfaction, why not stick to that which you know to be good, and not be carried about by every plausible story told you by interested salesmen? This, of course, would save you a constant repetition of making tests.

To repeat again: When you find a brand of lead made by manufacturers who have won for themselves a reputation for uniform, good colored, good bodied and finely ground white lead, having the best working qualities, you ought to feel reasonably certain that you will receive right along what you have received in the past.

The product of houses that put out lead which runs uneven need very close and constant watching. When it is to be considered that in nearly every instance the price for white lead is the same for all strictly pure brands, or there is but a small fraction of a cent. difference at best, it is really to be wondered at that people will take any chances at all.

But to "return to our muttons," as the French say, which in this case is testing white leads. It may be stated as an axiom that white lead properly ground dry, with linseed oil, will take up more oil than pulp lead or lead which is taken from the water mills, after water-grinding, and into which the linseed oil is squeezed in that state. (Many writers, however, have, do, and probably will, deny this.) It may be well to add that, to a certain extent, the larger quantity of oil which the dried lead, ground in oil, will take up over a pulp lead, will be found to be due to the extreme care used in its grinding—first, in the water mill, and its proper floating afterward. A poorly ground lead, dried and then ground in oil, would probably not take up any more oil than a finely ground pulp lead.

This being the case, it naturally follows that a lead properly dry-ground will take up more linseed oil than pulp lead, and more gallons of paint, ready for use, can be made from a 100-pound keg of the former than of the latter. It will, from this cause, spread over more surface and consequently be more economical to use. To make comparative tests of this, let the painter proceed in some such way as that which follows: Weigh an equal quantity of each lead to be tested; put into each sufficient oil to reduce it to a proper working order—just such a thinning as you would give under ordinary circumstances for actual work. For this first coat it would require lots of it, as we are now doing a priming coat over wood. One of the leads may require, perhaps, more oil than the other. No matter, only take care to charge up the oil used to thin each properly and separately. You must keep an account also of the number of square feet painted with each brand.

Before proceeding with the next coat it would be well for the operator to note the working qualities to see if one lead is not superior to another in holding together; in other words, if one of the leads will not drop from the brush and spatter much more freely than another. Let him make a note of it, for if it does, it is a very bad and costly trick; such a lead should not be used when other leads can be had.

The operator will be somewhat disappointed in this first coat work. If one of the leads be much finer ground than the other, he will find that the coarser lead has apparently covered the best of the two. This may lead many to form an erroneous judgment of the finer lead.

As poorly made lead is almost universally poorly ground as well, it will be found too coarse to penetrate the pores of the wood, and from this cause will show, apparently, a better covering than that which has been finely ground and which has penetrated with the oil into the pores of the wood. But, patiently wait until the next coat is put on, and that will settle this apparent body beyond dispute.

In second coating, it goes without saying that the same course must be still pursued in weighing the various leads in equal quantities and in keeping a strict account of the quantity of oil used to thin each. In this coat the leads must be applied so as to present an equally good covering over the priming. It will be found that the finer, well-made lead will have covered all the way from 10 per cent. to 40 per cent. more surface than the poorly made and coarser one, and that the surface presents just as solid an appearance at a small trifle of an increase in the cost of the extra oil required.

It would be well to conduct the experiment through another or third coat upon the same principle. This coat will show a still greater difference in favor of the finer lead.

Does it pay to use the better prepared and finer ground lead? Does 10 to 40 per cent. of saving amount to anything in the course of a year to a man employing, say, 100 men, and to others in the same proportion?

But this is not all, and probably is the very least of the savings effected, by long odds.

Of two journeymen employed—one using a bashful, ashamed-of-itself-kind-of-tear-dropping lead, and the other using a lead clinging to the oil, and which carries easily from the pot to the job and stays in the brush. One will spend two-thirds of his time slapping the sides of the pot with his brush, or drawing it across the top of his pail to remove the extra quantity, which his brush would be unable to carry as far as the job without spilling. The consequence is that when he does get his brush on the job it is in a half-loaded condition and already tired out. While he is doing that and giving himself a lot of internal talk, if he is a good churchman, and if he is not (which more frequently occurs than not), he lets loose and the air becomes blue from brimstone talk. This talk, besides the enervating influence it may have upon the workman himself and the polite ears of the neighbors, is apt to create a bad impression as to the character of the men employed by the contracting painter, and to give his shop a bad name.

Men who are generally sweat-proof under the most trying circumstances are said to be completely overcome in their good resolutions after working 30 minutes, by the watch, with a leaky lead.

But let the poor devil alone, and let us see how the other workman gets along. He is dipping his brush, up to the binding, in the paint, and easily carrying it, well filled, to the job. He wastes no time slapping and scraping surplus paint off, and has a square yard of painting covered over while the other unhappy victim is very likely muttering idle words which, it is often wondered at, do not turn white lead into a black sulphide of lead from contact with sulphureted gas. So that there is a saving, not only in the greater number of square feet painted over with a given number of pounds of lead, but also upon the cost of application, which is often of greater value than the saving made on the lead itself. To say nothing of the greater purity of tone when tinted, or of its greater brilliancy and whiteness when used alone, for it is a fact that a gray-toned lead will muddy tints made from it.

Another method of testing lead for spreading, body, and evenness of laying upon surfaces is to take a few panes of window glass, of any given size, and to carefully weigh an equal number of them for each lead to be tested, this weighing to be done before painting them. Take the leads, thin them about alike, and paint upon the glass allotted for each, laying it off about as well as possible. While in the wet state it will be well to mark them with a pencil with the initials of the brand used in testing. When dry, weigh carefully the various panes, then subtract the weight of the unpainted panes. The difference will give you the quantity used in each case.

The coarser lead will not lay down on the glass as smoothly as the finer, and will show more streaky than the finer; and while requiring a larger quantity in weight will not look as well as the other.

It is hoped that some accurate record of tests will be made upon the lines indicated. It will pay everybody using lead to make such tests. Be accurate, and do not be content with one or two, but make such tests often, until you strike a fair average of the various brands you wish to test.

The Depression in Manufacturing Industries

Bradstreets says that the effect of the prevailing monetary stringency or general depression in trade on manufacturing industries throughout the country becomes a matter of interest at this time, in view of the numerous reports of the closing of manufacturing establishments.

The earlier stage of the squeeze in credits, as is usually the case, was seen in the extreme liquidation in Wall Street, and the second phase, in logical order, has been and is being observed in its effect on manufacturing industries.

Returns have been received concerning nearly 800 establishments, nearly all of which are of more or less prominence, and all of which have closed their doors for one cause or another since June 1. The report likewise includes the best available information concerning the discharge of the number of employees of silver mining companies in the far West, as well as of employees rendered idle by the shutdown of iron ore mines. So far as changes of the character referred to at a few of the larger business centers are concerned, many reports by trade unions or statistical bodies having access to such data have been employed.

A summary of the results of the investigation shows that no fewer than 463,000 industrial, building trades and mining employees have been thrown out of work within the period specified, due to the absolute closing of the establishments at which they were engaged or the shutting down of the work at the mines.

Of this large aggregate no fewer than 80,000, or 17 per cent., were engaged in the production or the manufacture of iron and steel; 55,000, or 12 per cent., in woolen, silk and cotton mills or in the manufacture of clothing; 50,000, or 11 per cent., in leading lines in building trades at a few of the larger cities; 44,000, or 9.5 per cent., in silver mining and allied industries, and 41,000, or 9 per cent., in coal mining and coke producing. Of the aggregate of these five classes, 270,000, it is possible that as high a proportion as 30 per cent. are customarily idle for a short time at this season of the year.

It is noteworthy that out of the approximate aggregate of 800 establishments reported shut down about 79 per cent. declared this action is taken because of the prevailing "depression in general trade," a "lack of orders." "stringeney in the money market," or "inability to make usual discounts due to tight money," while only 6 per cent. state that the shutdowns are due to usual vacations at this season of the year, or owing to the necessity for making repairs or for taking inventories. Strikes or wages disputes are given in explanation of the closing down of only 2 per cent. of the establishments reported, while failures in business or other embarrassments, fires or other disasters, account for the shutdown of about 3 per cent. of the concerns reported. Less than 1 per cent. state in so many words that shutdowns are owing to "impending tariff changes."

When it is realized that this report, complete as it may be, is quite incomplete so far as the country at large is concerned, even with respect to manufacturing establishments which have wholly closed down for one reason or another, and that it takes no account of the thousands of reductions of working forces in other manufacturing establishments, in commercial houses, or by transportation organizations, large and small, it becomes plain to the casual observer that there are in all probability no fewer than 800,000 or 900,000 idle employees of manufacturing, commercial and other enterprises at this time who were nearly if not all actively employed three or four months ago, and that not more than from one sixth to one fifth of this aggregate may fairly be said to have been out of work during the past two months owing to the "customary midsummer shutdowns," or to the necessity for repairs or to taking of inventories, even though the not infrequent midsummer wages dispute in the iron and steel industries be taken into account.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CERTIFICATE incorporating the Gas, Security and Guaranty Company has been filed with the County Clerk of Jersey City, N.J. The Company proposes to manufacture and construct plants, machinery, tools, apparatus and devices, and the conducting and developing of processes for the manufacture, use and distribution of gas for light, heat and power. The Company is capitalized in $1,000,000. We will have more to say about this corporation when the proper time comes.

MR. W. A. STRONG, President of the Joliet (Ills.) Gas Light Company, died at St. Clair, Mich., on the afternoon of August 24th. Deceased was very prominent in the public affairs of Joliet, and at one time was Mayor of that city.

THE City Council of Richmond, Va., has reduced the price of gas for cooking, heating and power purposes to 75 cents per 1,000 cubic feet.

THE Trustees of the village of Ellenville, N. Y., have been restrained by Judge Barnard from selling $18,000 of village bonds for the purchase of the local gas plant, on the ground that the voters had not given their consent by ballot. The Trustees assert that an election was unnecessary, as they were given power to act by a special grant from the State Legislature. The local electric light company is the instigator of the litigation.

THE 46th annual meeting of the stockholders of the Providence (R. I.) Gas Company was held on the first Monday of September, the President (Mr. Amos C. Barstow) in the chair, with the Secretary (Mr. A. B. Slater) recording. President Barstow read the annual report of the Directors, which, in substance, was as follows: "We congratulate both ourselves and you that while witnessing many changes in organizations like this for gas illumination in many of our large cities, we meet to-day under our old charter and by-laws, and that our business runs on guided by the same general principles that were introduced at the beginning. We still do our business on a cash capital. We have issued no bonds, so common of late years. We have no personal debt, no watered stock, and no speculative combination with other men or corporations. Our plant to-day, notwithstanding costly changes in processes and machinery for purposes of permanent improvement, is worth all it cost, and more than is represented in our construction account. This fact, in connection with our fair and steady dividends, justifies the high market value of our

stock, even in these times of fluctuation and general depression in public securities. The conservative principles which have guided the administration have walked hand-in-hand with the spirit of intelligent enterprise. During a series of 12 or 15 years, in which a multitude of inventions were pressed upon our attention by enthusiastic inventors or their skilful representatives, we examined all, rejecting the mass, selecting the few. We know of no better process of manufacture, and no better apparatus for the production of either coal or water gas in use than ours, and no plants in the land which are in better condition or showing better results than our own. The amount of gas produced for the year ending June 30th last was 530,459,000 cubic feet, showing an increase over the previous year of 15,388,000 cubic feet. Of the gross amount produced, 44.31 per cent. was water gas and 55.69 per cent. was coal gas. Both kinds of gas are made at each of the two stations, and are mixed before being passed together through the purifiers. The receipts for residual products for the year were $47,279.49. This shows a falling off in the receipts for these residual products of $5,435.19, mostly from coke, because we have had less to sell. The amount of gas coal carbonized, from which all these residuals come, was 21,167 tons, or 5,671 tons less than last year. The amount of naphtha used in carbureting water gas was 1,379,938 gallons, or 373,204 gallons more than we used the previous year. The amount of Lehigh coal used in the production of water gas was 6,222 tons. There was also used in the manufacture of water gas 34,710 bushels of coke. Our contracts for coal of the best quality, and also for naphtha, cover all our anticipated wants for the next six or eight months at satisfactory prices, and we are kept in full supply at each station. The stock of coal in sheds on the 1st of the current month being 8,355 tons of gas coal, 4,659 tons of Lehigh coal, and of naphtha in tanks 297,152 gallons. The length of main pipes laid was 42,981 feet, or about 8¼ miles—an increase over the previous year of about 40 per cent. This gives us an aggregate of more than 190 miles in the ground and in use, besides 6 miles or more laid by the Citizens Gas Company still in the ground and unused. Besides this large amount of new mains laid we have to report the unusual large amount of 16,146 feet, or over 3 miles, of old pipe relaid or replaced by new or usually larger pipe. The number of meters in use is 17,077, an increase of 1,168 for the year. The number of gas stoves out on the 1st of July last, for cooking and heating, was 6,589, a net gain of 580 for the year. We are glad to say that for the past year we had no call for unusual outlay, save in the department of main and supply pipes, caused by the large extensions of the system of sewerage adopted by the the City Government. While this has put many of our citizens in inconvenience, it has also put us to large cost. Sould we estimate and honestly state our opinion of our loss in dollars and cents from the commencement of the work for water supply and sewerage to the present time, we should be deemed extravagant. Our payments to the city under the franchise contract for one year, less 38 days, amount to $15,479, and will reach about $17,000 for the full year, with an increase from year to year proportioned to the increase and sale of gas. The contract allows us to make dividends of 8 per cent. per annum, at prices for gas not higher than prevailed at the date of the contract. It also requires us to reduce the price of gas as fast as we can consistently. This is not a new rule. It is a self-imposed rule under which we have been working with verbal promise to the public for many years. From July, 1879, to July, 1890, 11 years, of our own motion we have reduced the price of gas 9 times, going in all from $2.25 per 1,000 cubic feet down to $1.30 per 1,000. This habit of reducing prices has become so much a part of our nature, that before the expiration of three-fourths of the first year under the new contract, we found ourselves figuring to see if we could safely make another reduction in the price of gas. Hoping for lighter expenses and some increase in sales as compared with the past calendar year, at our May meeting we voted to make another reduction from $1.30 to $1.20 per 1,000 cubic feet, on and after July 1st last. The increase in sales up to this time has been all and more than we anticipated. Whether this will be maintained in the coming months, should the present money stringency, with consequent disturbance of trade, be long continued, is somewhat doubtful. While under the new agreement we have the right to advance to the old price ($1.30), we hope that there will be no occasion to use it. We should feel a good degree of confidence in this but for the action of the City Council since our last annual meeting extending its system of lighting the streets by electricity, which promises to supplant, perhaps, 1,000 or more of our present street gas lamps. The year now closing shows no changes in the personnel of our Board. Those who saw the opening live to see the close. But few boards of officers as large as this pass through a series of 46 consecutive years with so few changes. The office of President has had but two occupants, the first serving 29 years and dying in office, and the last is now closing his 16th year of service. That of Vice-President has had but one occupant, the present incumbent having filled it from the date of its creation, 18 successive years. That of Treasurer has had but two occupants; the first filled it for 23 years and died in office, and the last is now closing his 24th year, still in youthful vigor. Of the 27 gentlemen who have served as Directors, 12 have died in office, 6 have resigned, and 9 (a full Board) are still in service. Of those 12 who died in office, 7 were of the 9 who constituted the first Board elected in 1848. Five of those 7 served respectively, 30, 29, 26, 24 and 22 years. The average service of the present members, though the last elected has served but 3 years, is 19½ years. The decease of one of the original Directors occurred before the completion of his fifth month of service. The gentleman who was then elected to fill the vacancy in the Board, and who served from November 6, 1848, until September 3, 1855, and then removed from the State, is still living in comfortable health and is still a stockholder." On the adoption of the report the shareholders re-elected the retiring Board of Directors, as follows: Col. William Goddard, Hon. Amos C. Barstow and Messrs. Alpheus B. Slater, Royal C. Taft, Edward Pearce, Jesse Metcalf, George W. R. Matteson, Lucian Sharpe and Newton Arnold. After the adjournment of the stockholders' meeting the Directors perfected the following organization: President, Hon. Royal C. Taft; Vice-President, Hon. Amos C. Barstow—Mr. Barstow declined a re-election as President; Treasurer and Secretary, Mr. Alpheus B. Slater.

THE new holder for the Bethlehem (Pa.) Company will be completed by October 1st.

A QUEER issue and the equally queer settlement thereof is reported from Middletown, Conn. As the result of several conferences, springing from the dull times in that city, the merchants and shopkeepers agreed to close their stores three nights in each week—barring the weeks of December—during the year, and then a delegation was named to wait upon the Middletown Electric Light Company to ask the proprietors thereof to reduce the lighting bills in the sum of 30 per cent. The Company offered to make a 20 per cent. cut, whereupon the merchants held an indignation meeting and decided to discontinue all lights furnished by the Company, gas lights to be substituted therefor until the Portland Electric Light Company (which does business in the town of Portland, situated opposite to Middletown on the East bank of the Connecticut river) can arrange to carry its wires under the river for the supply of Middletown.

AT the annual meeting of the Concord (N. H.) Gas Light Company, the Honorable John Kimball, who served the Company as President since the death of Mr. Nathaniel White, declined a re-election to that office. The Directors chosen were: Josiah B. Sanborn, Henry McFarland, John Kimball, Ferdinand A. Stillings, John P. George, Lyman D. Stevens and Benjamin C. White. The Directors subsequently selected the following officers: President, Josiah B. Sanborn; Treasurer, John Kimball; Clerk, Sylvester Dana. The report of the Treasurer showed that during the year a special dividend of 15 per cent., amounting to $45,000, had been paid to the stockholders from the sale of the electric plant, and two dividends of 3 per cent. from the earnings of the Company.

CARL WENNTROCK, a German mining engineer of some repute, reports the discovery, in San Bernardino, Orange and Los Angeles counties, of valuable deposits of anthracite coal of excellent quality. This would prove of inestimable benefit to the residents of the Pacific Coast, but it is feared that Mr. Wenntrock is over-sangiune. The value of the "find," however, will soon be known.

THE plant of the Camden (Ark.) Electric Light Company was sold at auction early this month, by order of the Receiver. The General Electric Company, of Chicago, was the purchaser, at its bid of $30,000.

THE following are the rates for commercial electric lighting established by the city of Tacoma, Wash.: Arc lights (2,000 candle power), burning to midnight, $10 per month; burning all night, $15; public lights, all night and every night, $12. Incandescent lamps, 16-candle power, to 10 P. M., $1.40 per lamp per month; to midnight, $1.55; all night, $2.50; 32 candle power, to 10 P. M., $2.75; to midnight, $3.25; all night, $5. Renewals of lamps will be made at the following rates: 16-candle power, 70 cents each; 32-candle power, 90 cents. As we understand it the city owns and operates the electric lighting system of Tacoma.

THE Peoples Gas Light and Coke Company arm of the Chicago Gas Trust will issue $10,000,000 fifty-year 6 per cent. first mortgage bonds, dated October 1st, of which $4,600,000 will be used to redeem outstand-

ing bonds. The scrip in payment of the dividend recently declared will, when presented in multiples of $1,000 to the Central Trust, be exchanged for bonds.

MAYOR STUART, of Philadelphia, on the 7th inst., forwarded to the City Councils, with his recommendation that it be approved, the following communication, which explains itself:

Hon. Edwin S. Stuart, Mayor of Philadelphia—Dear Sir: The Department, in computing the estimate for the appropriation to the Bureau of Gas for the year 1894, as submitted to the City Controller, has valued the income from gas supplied to consumers at the rate of $1.25 per 1,000 cubic feet for the year 1894, being a reduction of 25 cents per 1,000 cubic feet. While this reduction will decrease the income to the city treasury, it is equ table to those of the community who are taxpayers and to those who are not. The estimated cost of expenses is as follows:

For extensions	$776,500
For labor and supplies, maintenance, etc	2,466,000
For gas to be purchased	600,000
Total	$3,842,000
Estimate of income from consumers, based upon a $1.25 rate, and upon the assumption that the city will pay for gas consumed in public buildings, etc.	4,164,000
	$321,500
From the above amount there is to be credited the cost of public lighting (lighting and maintenance of gas lamps by the Bureau of lighting)	180,000
Leaving a balance of	$141,500

of estimated income in excess of estimated expenditure. It should be stated that the probable cost of permanent improvements is included in the estimate for extensions. I recommend that the City Departments, large consumers of gas, be required by ordinance to pay into the city treasury for the gas consumed by them, and that estimates be made by each of the amount of gas it requires for public use, and an item in the appropriation be made to each Bureau to pay for the gas it uses. It is argued that there is no necessity for the separate accounts, as the city receives the benefit. It is, however, a proper method of business to keep the expense account of the Bureaus separate in this particular as in others, and it is the only one which will enable the Bureau of Gas to define its income account in relation to its expenditures, and is essential to intelligently fix a minimum rate for the price of gas to the public. I respectfully request that this recommendation will receive the favorable consideration of Councils. In the months of January, February, March and April of the present year there was an increase in consumption of 25,000,000 feet per month over corresponding months of 1892, with a proportionate increase during the succeeding months. In considering the increasing demands of the public for additional quantity of gas, the condition of the gas works of the city to supply it should be stated. Aggregate amount of gas manufactured in 1892, 3,584,589,000 cubic feet; estimated quantity to be manufactured for 1893, 3,985,000,000 cubic feet. Maximum quantity of gas to be made by the city from coal during 1893, 2,093,108,190 cubic feet; gas to be purchased from the Philadelphia Gas Improvement Company during 1893, 1,891,891,810 cubic feet. There will be required to be purchased in excess of that purchased in 1893, possibly 270,270,000 cubic feet. Councils should now determine whether it is to the best interest of the city to obtain by purchase the plant of the Philadelphia Gas Improvement Company and control the entire manufacture of gas, and make the necessary additions to the works required to store the increased quantity of gas to be made, and make appropriations therefor, or to authorize the extension of the property of the Philadelphia Gas Improvement Company. It is to be observed from the former statement of the probable output of gas in 1894 that the Philadelphia Gas Improvement Company will furnish to the city about 50.8 per cent. relative to the amount computed to be manufactured by the city in 1893. If further extensions of the plant of the Philadelphia Gas Improvement Company be authorized, no appropriation will be required to be made by the city, but the Company will control 50.8 per cent. of the city's gas supply, and, unless action is taken by Councils to provide facilities to the Bureau of Gas, for the city to manufacture for consumers, the percentage to be purchased will be much greater each year, and the control of the Company increase and that of the city decrease. The Department has before recommended the purchase of the present plant of the Philadelphia Gas Improvement Company within the Twenty-fifth Ward Works, and the extension of the Twenty-sixth Ward Works, the former because any further improvements made there would be then made by and be the property of the city, and the latter as the location is most desirable for extensions to the city plant, and would enable the removal of the manufacturing station from the Ninth Ward Works (Market street) at the earliest time. In the report for 1892 it was recommended that an appropriation be made for the additions to the Twenty-sixth Ward Gas Works for a holder capacity of 3,000,000 cubic feet, and for works, $1,000,000. The report for 1891 stated the deficiency in holder capacity, and the time has come when the city must provide additional holders to accommodate the larger quantity of gas that can be made from coal since the substitution of modern benches for those of the old pattern. The lack of holder capacity prevents the best use of these improvements, and interferes with a satisfactory or equal distribution of gas to consumers. While it is desirable to use the works of the city to their full extent to manufacture gas, to enable the Bureau to make a product at as near a cost as that for which gas is now purchased, the works must be provided with the best approved method for manufacture, and conducted with the greatest economy for maintenance, I most respectfully request that you present the conditions and necessities of the Department in the Bureau of Gas to Councils, with such recommendations as you may deem proper. Yours very respectfully, JAMES H. WINDRIM, Director.

DISTRICT CHIEF SAWYER, of the Boston Fire Department, has complained to the Fire Commissioners that Contractor Nevins, who is extending the mains of the Brookline Gas Company through the Roxbury district, is carrying on that work in a manner that threatens the good working of the Fire Department. The specific charge is made that the heaps of dirt close to the fire hydrants are such "that, in case of fire, the work of the fire engines would be seriously interfered with."

THE Milwaukee Gas Light Company has completed arrangements with the American Express Company whereby gas consumers can pay their gas bills at any one of the Express Company's money order offices in city. There are 60 of these offices, located in the leading drug stores in different sections of the city, and a list of the same is printed on the back of each gas bill.

AMONG recent changes in the working staff of the Philadelphia Bureau of Gas we note the following: Chas. Dungan, paymaster at the Ninth Ward Works, was succeeded on the 15th inst. by Rudolph McGirr, formerly Chief Clerk to Engineer Park, and Charles Knowles succeeds the last named. James Wilkins succeeds Joseph Springer as Yard Superintendent.

"OBSERVER" forwards the following under date of Sept. 12th: "The new office building of the Hartford City Gas Company, which is now being erected from plans submitted by Mr. George Keller, will be ready for occupancy some time the coming winter. The building, which is to be one of the handsomest on Main street, is to have a frontage of 34 feet, a depth of 142 feet, and height of 62 feet. It will practically be four stories in height. The base of the front will be of granite, and the front proper will be a mixture of Bedford stone and terra cotta. The stone, which is of a light gray color, will be the only sample of the kind in any Hartford building. The south wall, which faces the grounds of the Church of the Redeemer, will be of brick, of a light grayish color. The lower floor will be used exclusively for the purposes of the Gas Company—a handsome stove show room will be one of the prominent features—and the balance of the building will be devoted to general office and apartment uses."

THE proprietors of the Pawtucket (R. I.) Gas Company have just closed a contract under which they agree to furnish the power necessary to operate the Union Railroad Company's lines on Garden and Main streets, between Pawtucket and Providence.

SEVERAL other aspirants for a franchise for operating a gas works in Kansas City, Mo., have appeared, the same, of course, to become effective on the expiration of the present Company's grant. The most prominent of the newcomers is the National Gas and Water Works Company, of Chicago.

THE leakage of the Company doing business at Rutherford, N. J., is said to exceed 50 per cent. Trees are withering on every road in which there is a gas main.

The Heat of Combustion of Coal Gas in Relation to its Illuminating Power.

[Abstract translation made by the *Journal of Gas Lighting* of a paper read by M. P. Agutton at the last meeting of the Society of French Gas Engineers.]

The increasing application of coal gas for heating, motive power, and more especially for incandescent lighting, has drawn attention to the little-studied subject of its heat of combustion. From analytical data, MM. Aime Witz, Mahler and Bueb have calculated (on a scarcely legitimate basis) the heat of combustion as being 5,250, 5,600 and 5,115 calor-

ies per cubic meter, under normal conditions of temperature and pressure. It must be quite evident the heat of combustion will vary with the richness of the gas; and the present investigation was undertaken to ascertain the relation between the heat of combustion and the illuminating power of coal gas as ordinarily employed.

The gas for examination was prepared in an experimental apparatus—the rich kind being either produced from cannel coal, or being the early product of the distillation of ordinary coal; the poor being the later product of the same process. No common gas or air enriched by hydrocarbons was used in the experiments. The illuminating power was ascertained by a Dumas and Regnault photometer from the number of liters of gas required to be consumed to give a light equal to one Carcel hour, or by testing the gas burning at the rate of 100 liters per hour (instead of 141 liters per hour according to the English custom), against the decimally graduated candles adopted by the "International Congress of 1889," of which 9.6 are equivalent to a Carcel. The heat of combustion was determined by the Mahler bomb, which was selected for the following reasons: The calorimetric bomb, as used by M. Aime Witz in his experiments, allowed only a very small volume of gas to be operated upon, on account of the large quantity of air admitted to form an explosive mixture; and slight differences in temperature greatly affected the result. A large volume of gas was employed by M. Bueb; but his results were vitiated by all the errors inherent in a continuous method. M. Mahler's modification of Berthelot and Vielle's calorimetric bomb is more serviceable. It is an ordinary calorimeter with helicoidal agitator and an iron or soft steel cylinder, in which the explosion is carried out, provided with an iron wire, which is heated by the passage of an electric current, in order to ignite the gaseous mixture. The capacity of the cylinder is 573 cubic centimeters; and this volume is operated on, as the oxygen for the combustion is forced in, to a pressure of 5 atmospheres, from a cylinder of compressed oxygen. The thermometers have sufficiently open scales to permit a reading to 1-50th of a degree with the naked eye. An experiment can be carried out in about 20 minutes.

With this apparatus, gas of a hundred different qualities was tested, and the heat of combustion of a cubic meter of dry gas calculated—the vapor of water being considered as coudensed. These experimental results were plotted out graphically; the heats of combustion as the ordinates, and the illuminating power in decimally graduated candles as the abscissæ. On uniting the points, the curve is found to be practically a straight line represented by the equation $C = I \times 352.6 + 2,280$, where C is the heat of combustion of a cubic meter of gas, and I is the illuminating power in decimally graduated candles. If the illuminating power is stated in English standard candles, I must be divided by 1.41 in the above formula. From this formula the author compiled the table given in the article by Mr. Thwaite already alluded to. It shows that a cubic meter of gas of a photometric value of 9.14 candles under normal conditions, and the vapor produced by combustion condensed, has, at constant volume, a calorific power of 5,503 calories. From 4,043 calories given out by gas of 5 decimally graduated candles to 7,569 calories from 15-candle gas, is a variation of about 3,500 calories for a difference of 10 candles. It will be clear how great an error is committed if 5,500 calories are taken as the heat of combustion of any gas whatsoever. It will be further seen that this heat is closely related to the illuminating power of a gas, which confirms the conclusion of M. Sainte-Claire Deville that in coal gas the proportion of hydrogen and methane varies very little; that the benzine vapor is constant; but that the hydrocarbons condensed at — 70° C. (such as ethylene, propylene and acetylene) vary in amount and determine the illuminating power. If the proportion of hydrogen to methane is variable, the illuminating power is unaltered; but, owing to the heat of combustion of methane being greater than that of hydrogen, the calorific power may be greatly affected. It is proved, however, that the calorific value of coal gas is of the same order as the illuminating power; and, if known exactly, it forms at least as good a criterion of the latter as determinations with candles of doubtfully constant light giving power. Gas is at present employed partly for lighting and partly for heating purposes; but a time may come when it will be used almost exclusively in virtue of its heat of combustion. Under the circumstances, it is reasonable to inquire why an inexact system of photometry is retained in place of one which shows, in addition to illuminating power, the value of the gas for heating and motive purposes.

The next subject for consideration is the influence of the heat of combustion of coal gas on the lighting effect of the Welsbach burner. A second series of experiments was carried out with gas of different qualities, the heat of combustion being in each case ascertained by means of the Mahler calorimeter, and the light produced by consumption with a Welsbach burner by means of a Foucault photometer. The following table shows the results of the investigation:

Heat of Combustion of the Gas. Calories.	Lighting Power in Decimally Graduated Candles from 100 Liters of Gas.	Number of Calories for a Photometric Value of 10 Candles.
7,529	77.09	97.7
6,523	74.40	87.6
5,897	70.65	83 5
5,582	63.36	88.1
5,474	61.73	88.6
5,355	60.09	89.1
5,068	50.11	101.1
4,941	45.50	108.6
4,741	40.89	115.9
2,175 (impure H).	16.41	132.5

It will be seen that the photometric value of the gas rises with its heat of combustion. On plotting out graphically, the curve representing the increase of lighting value for increase of heating power rises regularly from 4,800 to 5,900 calories; but after that it does not go farther with increasing heat of combustion. This shows that the burner requires modification, either by making provision for the admission of more air, or by better mingling of the gas and air, for the economical consumption of rich gas. For poor gases, the curve becomes nearly a horizontal line. All the experiments were made with a No. 2 burner, provided with a regulated air supply. A comparison of the above table with the one already given, shows that, for gas of the same heating power, the Welsbach burner has a photometric value about seven times that of the Bengel burner with the same consumption of gas.

By dividing the number of calories obtained from 100 liters of gas by the illuminating power, there is found the duty of the burner—that is to say, the number of calories required to give a photometric value of 10 candles. This is not constant, and, on laying out graphically, the curve is found to pass through a minimum of 83 calories, corresponding to a combustion of 5,800 calories, or a gas of 95 liters value by the Dumas and Regnault photometer. This interesting result indicates that, assuming equality of price per calorie, gas of medium quality gives the maximum economy in the Welsbach burner. This minimum of 8 3 calories per candle approaches the efficiency of the incandescent electric light—one calorie corresponding to 9.6 watts per candle; while an incandescent electric lamp giving 16 candles at 100 volts for a current of 0.5 ampere requires 3.5 watts per candle. The Bengel burner gives a yield corresponding to 68 watts per candle, which shows how much more nearly the Welsbach burner approaches the electric light in duty.

There is one more point yet to be cleared up. An expert chemist recently stated that the light intensity of the Welsbach burner was independent of the quality of the gas consumed. This he demonstrated by using a certain gas, and then burning some of the same gas after the removal of its hydrocarbons by passing it over coke impregnated with colza oil. The illuminating power was said to be the same, hence he concluded that, in the incandescent system, poor gas gave the same lighting effect as rich. He even stated that, as the proportion of illuminating hydrocarbon was small, the calorific value of the gas should not be appreciably altered. This hypothesis has been proved above to be false; but the experiments have been repeated, with the addition of the determination of the calorific value of the gas. The results are as follows:

	Gas as Manufactured.	Decarbureted Gas.
Photometric value by the Dumas and Regnault apparatus	107.9 liters.	143 liters.
Light intensity of 100 liters in the Welsbach burner	5.70 Carcels.	5.54 Carcels.
Heat of combustion of the gas	5,355 calories.	5,200 calories.

It is clear that the heat of combustion corresponds closely with the the intensity of light in the Welsbach burner, but that it does not accord with the ordinary photometric value; and consequently the law just enunciated on the correspondence of the heat of combustion with the illuminating power of a gas appears inexact. The matter admits of easy explanation. In its passage through the colza oil the gas loses its hydrocarbons, but at the same time carries over mechanically some of the oil. The mixture is not sufficiently intimate for the traces of oil to be consumed in the Bengel burner, and the light produced is simply that of decarbureted gas. But, in the Welsbach burner, the colza oil, though not gasified, is arrested by the earthy film, and burns; thus producing the same effect as an enriched gas. Similarly, the heat of combustion is that of the gas plus the oil sprayed over by it. The correctness of this explanation was proved by passing a quantity of the decarbureted gas through cotton wool, which retained some of the oil carried over, as was demonstrated by its recovery by extraction with carbon bisulphide.

In addition to its usefulness for ascertaining the quality of gas, the Mahler calorimeter has certain other applications in gas works. Instead of analyzing heating gases by means of the Bunte burette, and calculating their calorific power, the result may be attained more easily by the calorimeter. Thus, taking two samples of gas, an analysis with the Bunte burette gave the following results:

	No. 1.		No. 2.	
Carbonic acid	8.4		6.0	
Oxygen	—		—	
Carbonic oxide	18.4	24.1	27.0	33.2
Hydrogen	5.7		6.2	

The heat of combustion, calculated according to Dulong's law, is 739 calories for sample No. 1, and 1,014 calories for sample No. 2. Rapid experiments with the Mahler bomb gave 730 and 1,031 calories respectively. This instrument also serves for chemical investigations, such as for the determination of the sulphur in coal, coke, or even gas. It therefore opens out a new and extensive field for research in connection with the gas industry.

The Market for Gas Securities.

Consolidated gains in strength steadily and surely, sales having been made last week at 131½, and the opening price to-day (Friday) is reported at 131½ to 132. No doubt those who parted with their stock below 120 wish they had not been so hasty. It is a decided purchase even at the present quotations. Mutual is offered at 135, and holders of Equitable ask 160—for the latter 155 is bid. Standard preferred is in demand at or about 80. In Brooklyn the feature is the sharp decline in Citizens, 590 shares of it having been disposed of on the Exchange at 55 per cent.; $2,000 of the same Company's bonds, consolidated 6's, due 1940, were disposed of at 78. Other Brooklyn shares show no particular change, although weakness is manifest in all. Chicago gas opened to-day at 60 bid. The increase in Baltimore Consolidated is well maintained, 58 being freely bid for it. Bay State common is at 20 to 21, and Laclede common is quoted at 15½ to 16. The East River tunnel scheme seems to be in the deep bosom of the East River buried. We understand that all work in connection therewith has been suspended, although we presume that the salaries of some of the "superior officers" are going on.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

September 18.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	131½	132
Central	500,000	50	90	95
" Scrip	220,000	—	—	100
Equitable	4,000,000	100	155	160
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	—	135
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Standard Gas Co—				
Common Stock	5,000,000	100	—	40
Preferred	5,000,000	100	—	80
Yonkers		50	112	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	110
Citizens	1,200,000	20	55	—
" S. F. Bonds	320,000	1000	—	103
Equity Gas Light Co	2,000,000	100	—	—
Bonds	1,000,000	—	—	—
Fulton Municipal	3,000,000	100	—	120
" Bonds	300,000		102	—
Peoples	1,000,000	10	—	90
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	—	120
" Bonds (5's)	70,000	—	100	—
Nassau	1,000,000	25	—	150
" Ctfs	700,000	1000	99	100
Williamsburgh	1,000,000	50	130	—
" Bonds	1,000,000	—	107	110
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	—	60
2d " " "	3,000,000	1000	40	—
Bay State Gas Co.—				
Stock	5,000,000	50	20	21
Income Bonds	2,000,000	1000	40	—
Buffalo Mutual, N. Y.	750,000	100	110	—
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
Chicago Gas Company	25,000,000	100	60	—
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	85	90½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	—	101
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	108
2d "	2,500,000	1000	104	105
Consumers Gas Light Co., Jersey City	2,000,000	100	—	25
Bonds	600,000	1000	—	85
Cincinnati G. & C. Co.	7,000,000	100	192	—
Consumers Toronto	1,600,000	50	190	191
Central, S. F., Cal			—	100
Capital, Sacramento, Cal			—	55
Consolidated, Balt.	11,000,000	100	58	58¼
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	85	101
Bonds	250,000		—	—
Detroit Gas Co.—				
1st Mortgage			85	87

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DIVIDEND NOTICE.

STANDARD GAS LIGHT CO. OF THE CITY OF NEW YORK, 71 BROADWAY, NEW YORK, Sept. 13, 1893.

At a meeting of the Board of Directors of the Standard Gas ht Company, held this day, a dividend of one (1) per cent. was declared on the Preferred Stock, payable October 2, 1893.

Transfer books will close Monday, September 25, at 3 o'clock P.M., and reopen Tuesday, October 3, at 10 o'clock A.M.

954-3 FERDINAND McKEIGE, Secretary.

SITUATION WANTED

As Superintendent of a Gas Works

by a man thoroughly posted in all branches of the business, including construction work. For ten years past has had full charge of a plant sending out 12,000,000 feet per year, but wishes to make a change. References given. Address

953-3 "W. C.," care this Journal.

Position Wanted

As Superintendent or Manager of a Gas or Combination Plant

by an experienced and reliable party. Good references. Address "HOLDON,"

952-4 Care this Journal.

FOR SALE, CHEAP,

Second-Hand Exhauster, capacity, 100,000 cubic feet per day; 8-inch connections.

One-Horse Power Otto Gas Engine.

One Set of Purifying Boxes, 8 ft. by 8 ft. by 3 ft. 8-inch outlets and inlets.

All in good condition. Address YOUNGSTOWN GAS CO.,

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For Sale.

Ironwork for Two Benches of 3's and One Bench of 5's, Complete.

For particulars inquire of THE WINDSOR GAS CO.,

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Valuable Gas Interest For Sale,

The undersigned will sell, to the extent of $20,000 to $50,000, in sums to suit purchaser, an interest in a growing gas business now netting 8 per cent.; increase this year will give net earnings of over 12 per cent. Money wanted for extensions to cover valuable territory. A magnificent opening for a party desiring a permanent occupation and investment in one of the most pleasant residence locations in California. Banks and business firms as references. Address for particulars and statement,

LOS ANGELES SAFE DEPOSIT AND TRUST CO.,
Stimson Block, corner Third and Spring Streets,

954-tf Los Angeles, California.

FOR SALE,

One 30-H.P. Otto Gas Engine

Good as new; only used six weeks. Inquire of

CHARLESTON GAS AND ELECTRIC CO.,

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FOR SALE,

Gas Posts and Street Lamps,

in good condition. Will be sold very cheap. Address

ROANOKE GAS AND WATER CO.,

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MANUFACTURERS OF

VALVES,

Double and Single Gate, ¾ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

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ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:

938 to 954 River St., & 67 to 83 Vail Av., TROY, N. Y.

FOR SALE,

Two Ten-Inch Dry Center Seals,

in good condition, and one

Small Multitubular Condenser,

4 ft. diameter and 14 ft. high.

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Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator.

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or
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Mechanical Engineer,

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Gas Governors,
Governor Gas Burners,
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In addition to a full assortment of Volumetric Governors, etc., I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters*. The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

Gas Light Companies Can Make Money

by selling our Improved Gas Engines, as well as by the consequent increase in the amount of Gas customers will use. Our Engine is declared by experts to be

"A MARVEL OF SIMPLICITY AND POWER!"

It has absolutely no Springs, no Cog Gears, no Stuffing Boxes, no Valve Stems or Guides, and in fact **No Complications**, yet every part is complete and positive in action and easily handled by the inexperienced. Our Engine entails no Boiler, no Fire, no Engineer, no License, and no Danger. We invite a call or correspondence.

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Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants with and without Independent Nozzle Valve. All Work Guaranteed.

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We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

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THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

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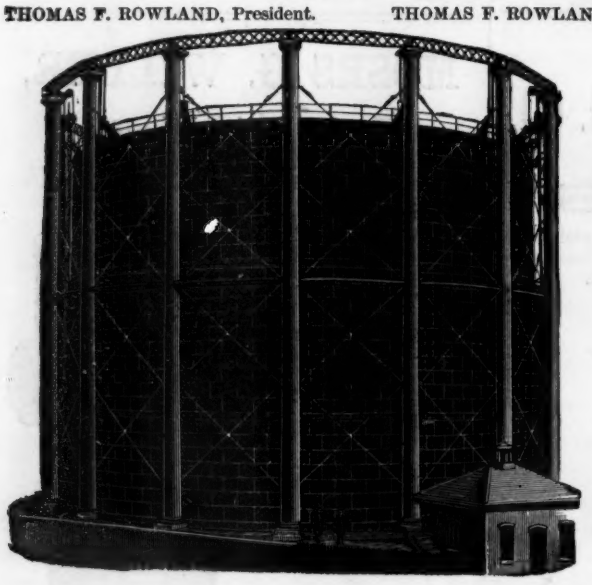

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Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.

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For Round, Oval, or "D" Retorts.

Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

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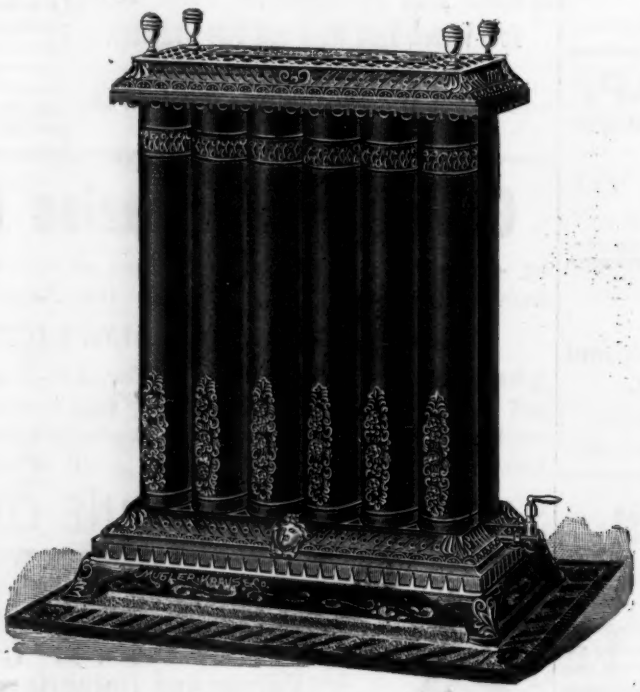

New Designs and

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The Largest and Most Complete Line ever Manufactured Under one Name.

The SCHNEIDER & TRENKAMP CO.,

Sole Manufacturers of Reliable Gas Heaters.

479-501 Case Ave., Cleveland, Ohio.

JEWEL GAS STOVES

Eleven Entirely New Ranges.

SEND FOR
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CATALOG.

71 STYLES,
Listing from 75 Cents to $73.

GEORGE M. CLARK & COMPANY,
Makers,
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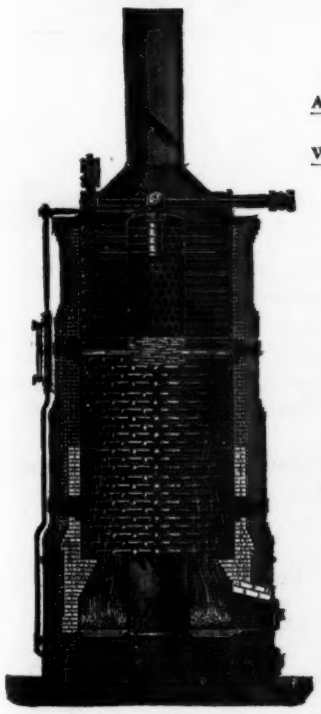
The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.
An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
THE HAZELTON BOILER.

THE PORCUPINE BOILER.
TRADE MARKS.

Special Sectional Boilers For Export.

The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

∴ BEWARE OF IMITATIONS. ∴

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

THE HAZELTON BOILER CO.,
Sole Proprietors and Manufacturers, NEW YORK, U. S. A.

Cable Address, "PAILA," NEW YORK.
WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.
Long Distance Telephone, 1229-18th St., New York.

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES.

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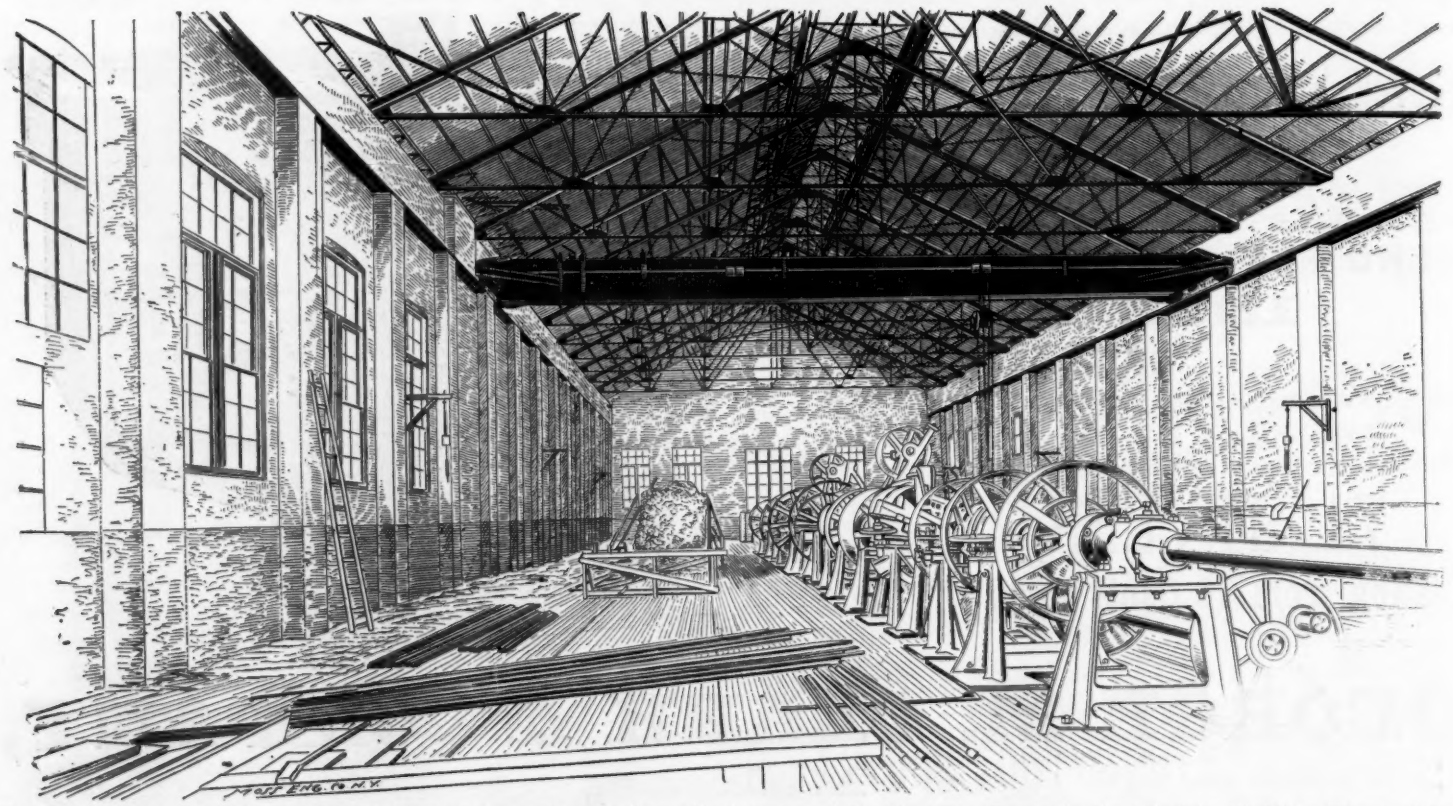
THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the interior of the Dynamo Room in the Electric Lighting Plant of the Elmira Electric Illuminating Company, at Elmira, N. Y. Besides this, there is a Boiler and Engine Room adjacent to the Dynamo Room. We furnished the Traveling Crane as well as the Iron Roof. The roof is covered with our Patent Anti-Condensation Corrugated Iron, and is guaranteed absolutely fireproof, and not to drip from the under-side during the coldest weather. The photograph was taken after the Roof Trusses and Traveling Crane were placed, but before the machinery was started.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER

FROM

GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu.Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

HIGH CANDLE POWER WELSBACH LIGHTS.

Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6.

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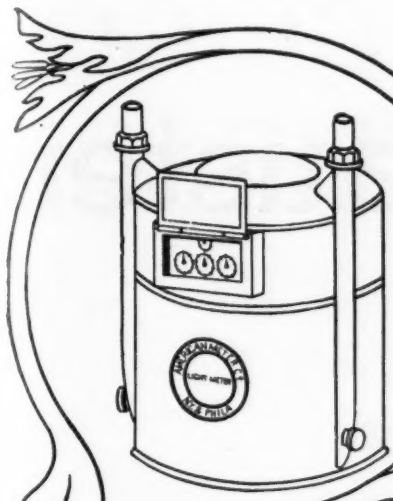
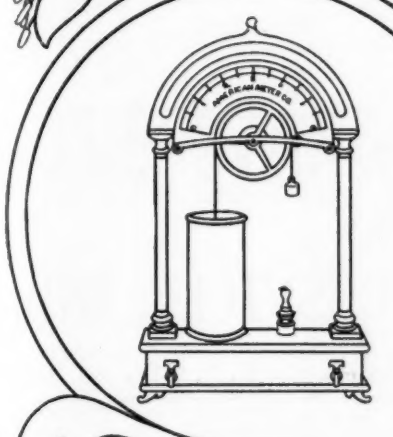
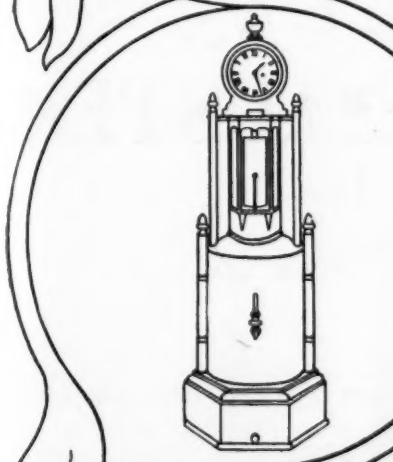






AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

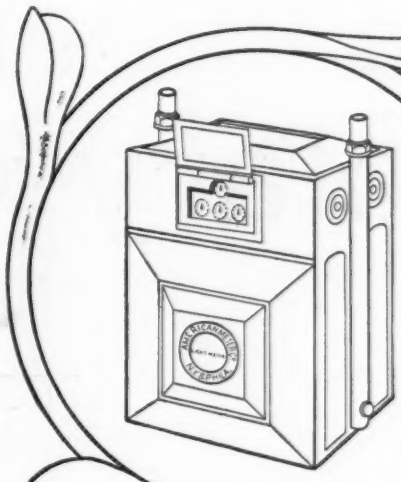
PUBLIC LIGHTING TABLE.

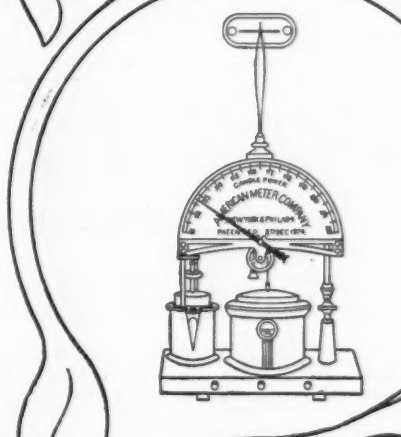
OCTOBER, 1893.

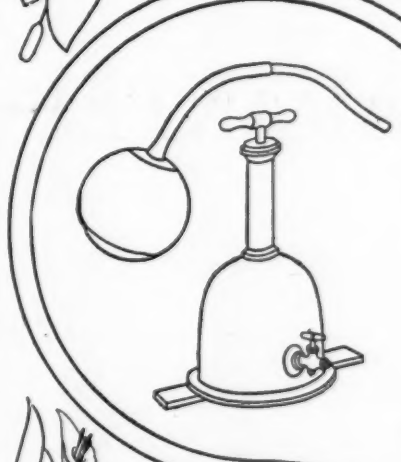
Day of Week.	Table No. 1. Following the Moon.			Table No. 2. New York City. All Night Lighting.	
	Date.	Light.	Extinguish.	Light.	Extinguish.
				P.M	A.M.
Sun.	1	6.10 PM	10.40 PM	5.30	5.00
Mon.	2	6.10 LQ	11.40	5.30	5.00
Tue.	3	6.10	1.00 AM	5.30	5.00
Wed.	4	6.10	2.10	5.30	5.00
Thu.	5	6.10	3.20	5.30	5.00
Fri.	6	6.10	5.00	5.30	5.00
Sat.	7	6.00	5.00	5.30	5.00
Sun.	8	6.00	5.00	5.20	5.10
Mon.	9	6.00 NM	5.00	5.20	5.10
Tue.	10	6.00	5.10	5.20	5.10
Wed.	11	6.00	5.10	5.20	5.10
Thu.	12	6.00	5.10	5.20	5.10
Fri.	13	6.00	5.10	5.20	5.10
Sat.	14	6.50	5.10	5.20	5.10
Sun.	15	7.40	5.10	5.10	5.20
Mon.	16	8.40	5.10	5.10	5.20
Tue.	17	9.40 FQ	5.10	5.10	5.20
Wed.	18	10.40	5.10	5.10	5.20
Thu.	19	11.50	5.10	5.10	5.20
Fri.	20	12.50 AM	5.20	5.10	5.20
Sat.	21	2.00	5.20	5.10	5.20
Sun.	22	3.10	5.20	5.00	5.30
Mon.	23	No L	No L.	5.00	5.30
Tue.	24	No L	No L.	5.00	5.30
Wed.	25	No L FM	No L.	5.00	5.30
Thu.	26	5.30 PM	6.50 PM	5.00	5.30
Fri.	27	5.30	7.30	5.00	5.30
Sat.	28	5.30	8.30	5.00	5.30
Sun.	29	5.30	9.30	4.45	5.35
Mon.	30	5.30	10.50	4.45	5.35
Tue.	31	5.30 LQ	12.00	4.45	5.35

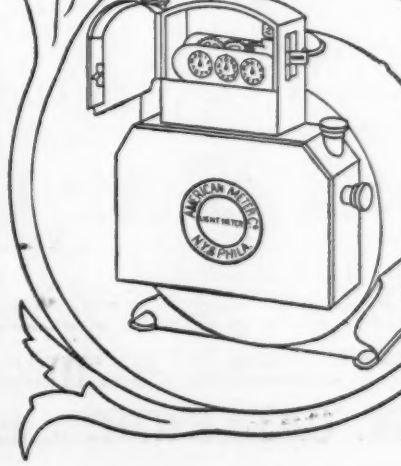
TOTAL HOURS LIGHTING DURING 1893.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July.....	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45









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NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each planed accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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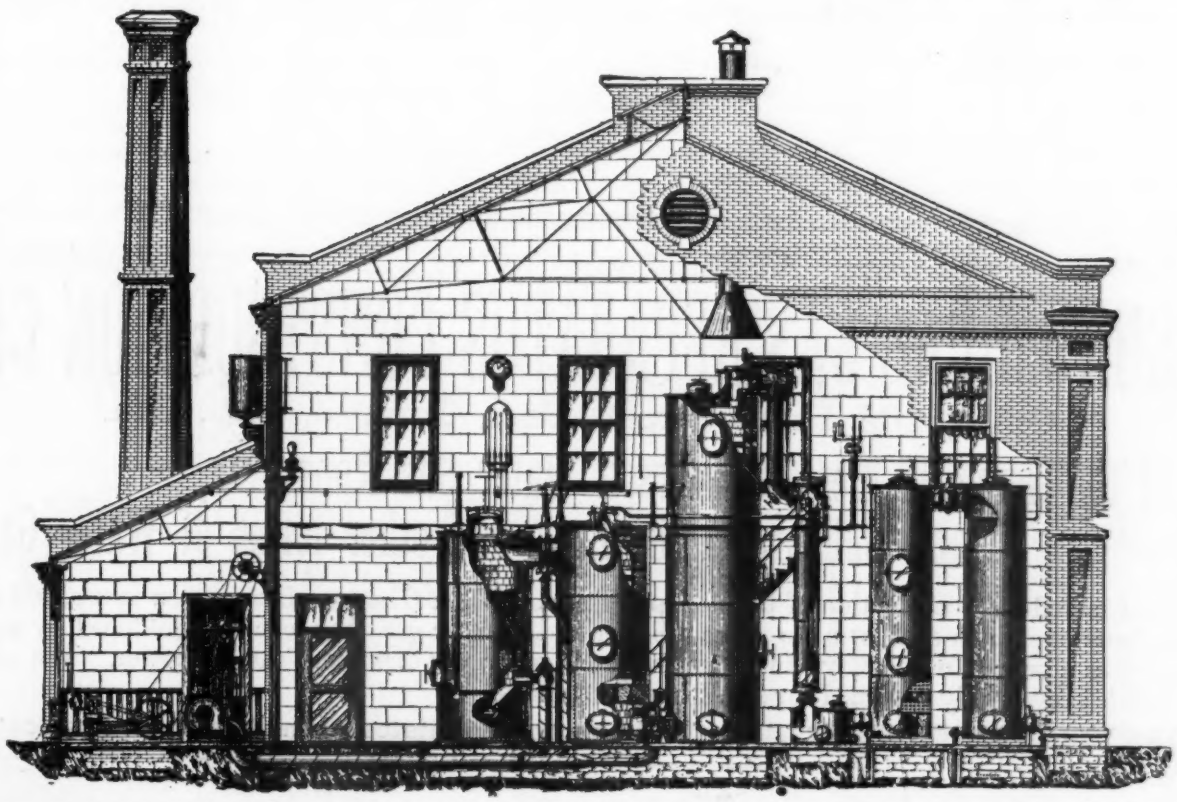
BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



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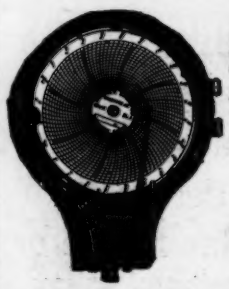

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Low in Price,
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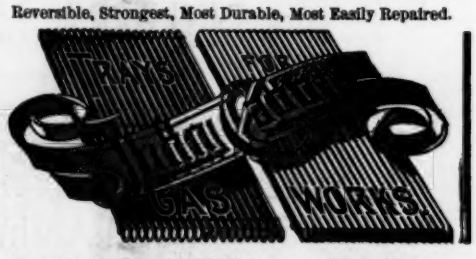

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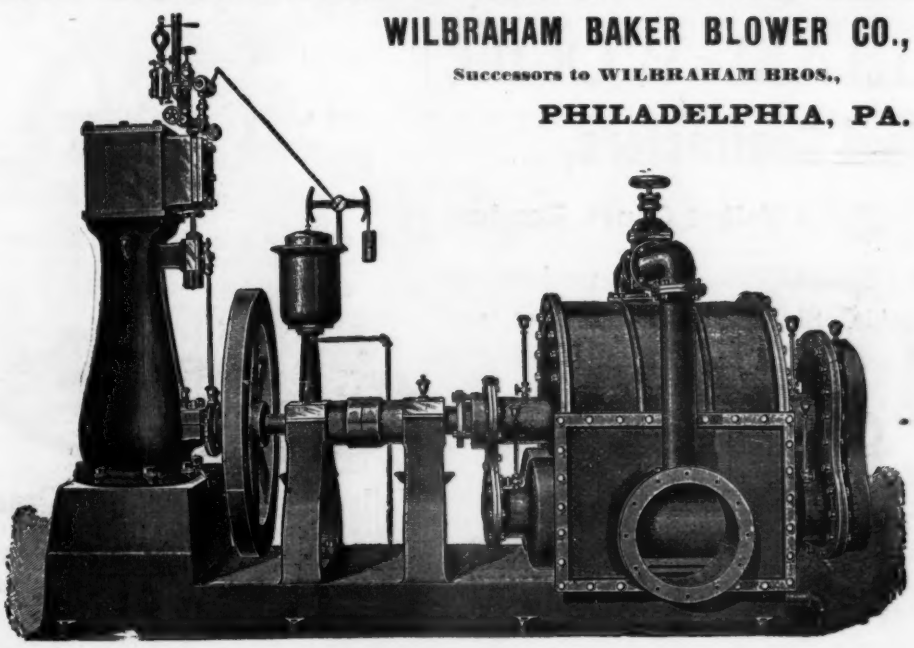

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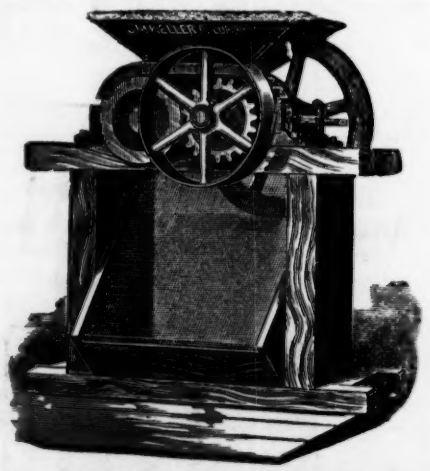

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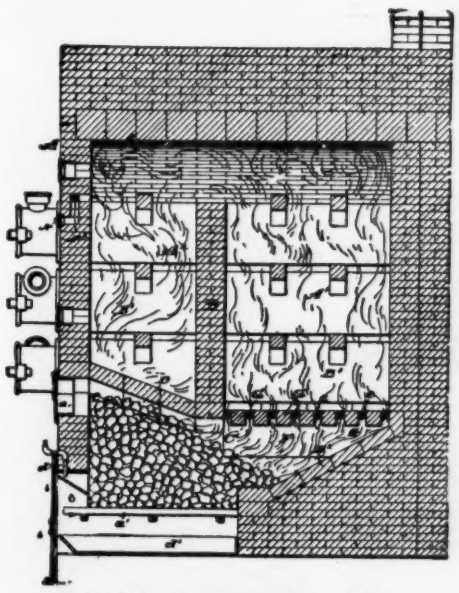

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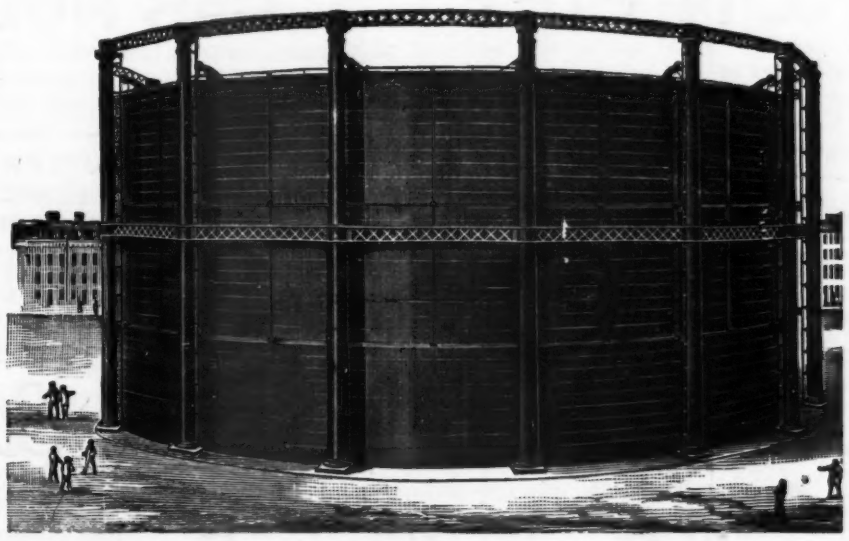

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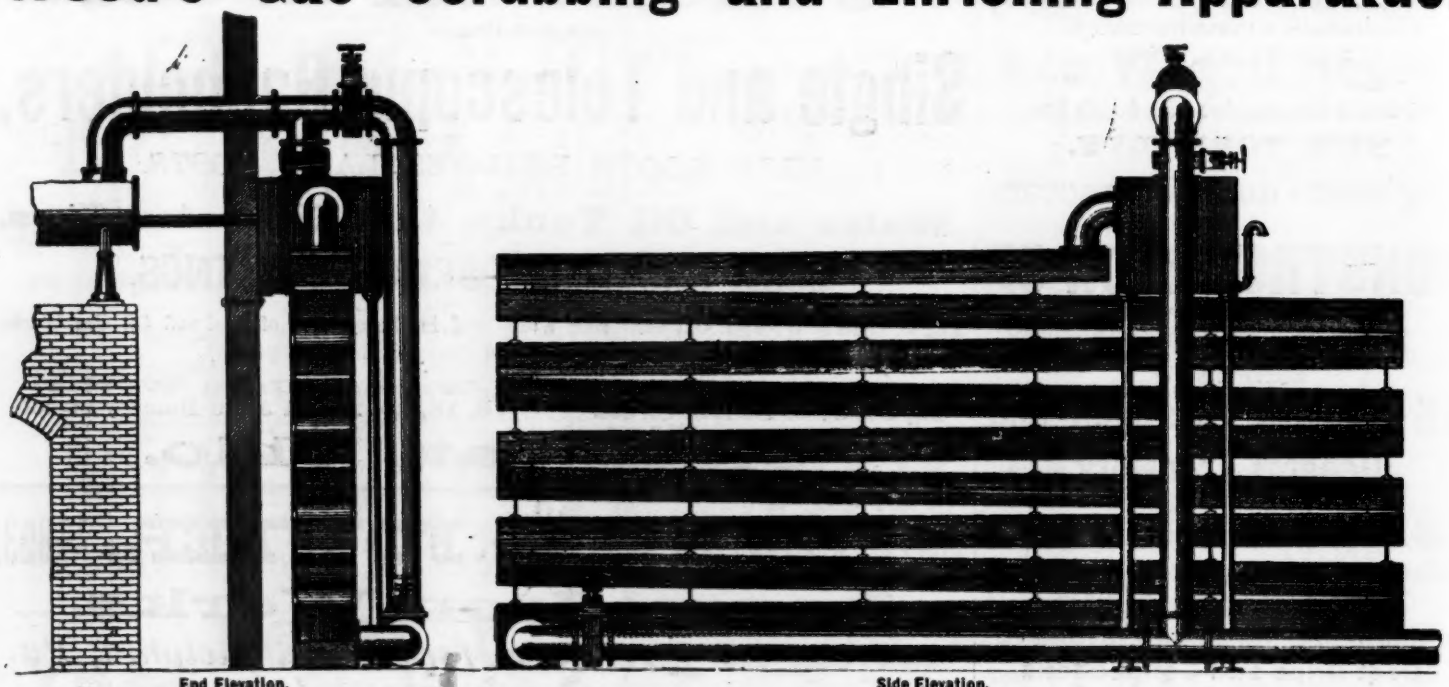

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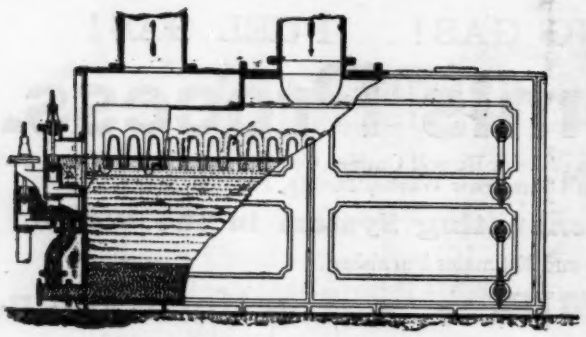

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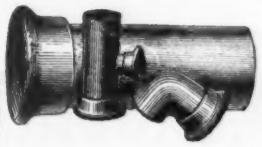

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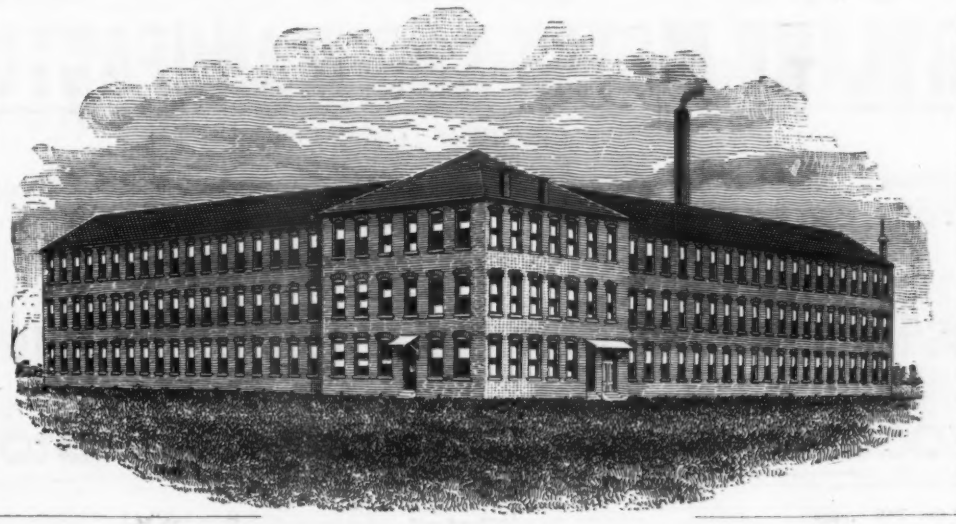

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The superior feature of this meter is that it avoids the danger of displacement of the valves, and consequent loss of gas, either in shipping, handling, or by dishonest consumers.

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Full descriptive circular sent on application.

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Mr. Thomas Fletcher, well known in the Gas Industry, gives his opinion on this question as follows

"It is essential for economical working, and consequent low prices, that the plant as a whole shall be utilized as far as possible for the whole 24 hours every day, summer and winter alike. If this ideal state of things could be attained, about three or four times the output could be sold with practically no addition to the capital expenditure, *and consequently the profits would be increased to four or five times the present amount*, or even more, as the staff expenses would not rise in proportion, an account of £25 being quite as easy to deal with as one of £5, and requiring no additional office work. Instead of being the best customers, *shopkeepers* and *owners of large works* are really *the worst* the gas industry has to deal with, spite of the large total amount, and the reason is simple. The consumption is enormous during two or three hours in winter, entailing the necessity of enormous holders and very large distributing plant, all of which is absolutely idle during the summer. THE BEST OF ALL CUSTOMERS ARE THOSE WHO USE GAS FOR ENGINES, workshop and industrial purposes, as these will use a steady supply for about ten hours daily, winter and summer alike, and *these are the users worthy of the greatest consideration.* Next to these come the users of gas cooking appliances and gas fires, they also being practically steady users for long hours both in the winter and summer. Domestic lighting does not come out anything so favorably, as the consumption in the winter averages over double that in the summer, entailing the loss on idle plant during a large portion of the year. The dream of the gas engineer is a large summer and 'day gas' consumption, and on *these depend large profits and economical working.*"

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